

REPORT OF THE
NATIONAL COMMISSION ON
AGRICULTURE
1976

PART VII
ANIMAL HUSBANDRY



सत्यमेव जयते



GOVERNMENT OF INDIA
MINISTRY OF AGRICULTURE AND IRRIGATION
NEW DELHI

P R E F A C E

The Report of the National Commission on Agriculture comprises 69 chapters in 15 parts. A complete list of chapters and parts is given in pages (iii) to (vi). The Terms of Reference of the Commission and its composition are given in Part I—Chapter 1—Introduction.

This volume, entitled 'Animal Husbandry', is Part VII of the Report and is divided into the following nine chapters :

28. Cattle and Buffaloes
29. Dairy Development
30. Sheep and Goats
31. Poultry
32. Other Livestock
33. Mixed Farming
34. Livestock Feeding
35. Animal Health
36. Meat Production and Animal Byproducts

Fodder crops have been dealt with in Chapter 25 in Part VI and some aspects of grassland development have been included in Chapter 42 of Part IX. Education and training in animal science form a separate section in Chapter 53 on Education and animal husbandry research has been discussed in Chapter 52 on Research of Part XI. Some aspects of animal husbandry administration and livestock statistics are dealt with in Part XIV. Certain other aspects of animal husbandry find mention in relevant portions of different chapters.

REPORT OF THE NATIONAL COMMISSION ON AGRICULTURE

PART I—REVIEW AND PROGRESS

1. Introduction
2. Historical Review
3. Progress of Agricultural Development
4. Some Economic Aspects

PART II—POLICY AND STRATEGY

5. Agriculture in Economic Development
6. Growth with Social Justice
7. Policy and Strategy
8. Centre-State Relations in Agricultural Development
9. Nutrition

PART III—DEMAND & SUPPLY

10. Demand Projections
11. Supply Possibilities
12. Export Possibilities and Import Substitution

PART IV—CLIMATE AND AGRICULTURE

13. Climate and Agriculture
14. Rainfall and Cropping Patterns

PART V—RESOURCE DEVELOPMENT

15. Irrigation
16. Command Area Development
17. Land Reclamation and Development
18. Soil and Moisture Conservation
19. Electricity in Rural Development

PART VI—CROP PRODUCTION, SERICULTURE AND APICULTURE

- 20. Reorientation of Cropping Systems
- 21. Foodgrain Crops
- 22. Commercial Crops
- 23. Horticultural Crops
- 24. Plantation Crops
- 25. Fodder Crops
- 26. Sericulture
- 27. Apiculture

PART VII—ANIMAL HUSBANDRY

- 28. Cattle and Buffaloes
- 29. Dairy Development
- 30. Sheep and Goats
- 31. Poultry
- 32. Other Livestock
- 33. Mixed Farming
- 34. Livestock Feeding
- 35. Animal Health
- 36. Meat Production and Animal Byproducts

PART VIII—FISHERIES

- 37. Inland Fisheries and Aquaculture
- 38. Marine Fisheries
- 39. Crustacean Fisheries and their Utilisation
- 40. Marketing of Fish and Fishery Products

PART IX—FORESTRY

- 41. Forest Policy
- 42. Production and Social Forestry
- 43. Minor Forest Produce
- 44. Forest Ecology and Wildlife Management
- 45. Forest Protection and Law
- 46. Forest Planning, Research and Education

PART X—INPUTS

- 47. Seeds
- 48. Fertilisers and Manures
- 49. Plant Protection Chemicals
- 50. Farm Power
- 51. Implements and Machinery

PART XI—RESEARCH, EDUCATION AND EXTENSION

- 52. Research
- 53. Education
- 54. Extension

PART XII—SUPPORTING SERVICES AND INCENTIVES

- 55. Credit and Incentives
- 56. Marketing, Transport and Storage
- 57. Processing and Agro-Industries

PART XIII—RURAL EMPLOYMENT AND SPECIAL AREA PROGRAMMES

- 58. Rural Employment
- 59. Special Area Development Programmes

PART XIV—PLANNING, STATISTICS AND ADMINISTRATION

- 60. Planning
- 61. Statistics
- 62. Administration
- 63. Farmers' Organisation
- 64. International Cooperation

PART XV—AGRARIAN REFORMS

- 65. Land Reforms Policy
- 66. Land Reforms Legislation and Implementation
- 67. Agrarian Structure and Perspective
- 68. Consolidation of Holdings
- 69. Agricultural Labour



PART VII
ANIMAL HUSBANDRY
C O N T E N T S

CHAPTER 28—CATTLE AND BUFFALOES

SECTION	PAGE
1 INTRODUCTION	1
2 TREND IN CATTLE POPULATION	3
Mortality among Youngstock	7
Problem of Excessive Cattle and Buffalo Population	7
3 ESTIMATES OF MILK PRODUCTION AND THE DEMAND PROJECTIONS	10
4 CATTLE DEVELOPMENT	12
Review	12
Approach under Five Year Plans	14
All India Key Village Scheme	16
Intensive Cattle Development Project	19
5 CATTLE BREEDING POLICIES	21
6 CATTLE BREEDING FARMS	27
Exotic Cattle Breeding Farms	30
7 MILITARY DAIRY FARMS	31
Breeding Policy	31
Progress and Achievements	34
8 GAUSHALAS	36
9 ROLE OF INDIGENOUS BREEDS OF CATTLE	39
10 ARTIFICIAL INSEMINATION	43
Dilutors	44
Semen Evaluation	45
Transport of Semen	45
Training of Lay Inseminators	46
Fee for Insemination Service	46
Evaluation of Conception Rate	49
Training of Personnel	50
Frozen Semen	51

	PAGE
11 CROSSBREEDING WITH EXOTIC DAIRY BREEDS	53
Review	53
Indo-Swiss Project, Patiala	55
Indo-Danish Dairy Project	55
Indo-German Agricultural Development Project at Mandi (Himachal Pradesh) and Almora (Uttar Pradesh)	56
ICDPs and Other Projects	56
Choice of Suitable Exotic Breeds	57
Level of Exotic Inheritance	58
Establishment of Herds of Exotic Dairy Breeds	59
Crossbred Bulls for <i>inter se</i> Breeding	60
Import of Exotic Cattle by Individuals/Private Institutions	61
Crossbred Bullocks for Draught Purposes	62
12 THE BUFFALO	63
Breeds and Types of Buffaloes	64
Buffalo Population and Trends	65
Buffalo and Dairy Development	67
Reproduction in the Buffalo	69
Artificial Insemination	71
Paucity of Superior Quality Stud Bulls	71
Seed Stock Farms : Progeny Testing	72
Buffalo for Meat	74
13 MILK RECORDING AND HERD BOOKS	77
14 PROBLEMS OF CITY MILCH CATTLE	81
15 CATTLE INSURANCE	85
Problems of Cattle Insurance	85
Cattle Insurance through Co-operatives	87
16 EXPORT TRADE IN CATTLE AND BUFFALOES	88
17 POLICIES AND PROGRAMMES FOR ACHIEVING MILK PRODUCTION TARGETS	90
18 SUMMARY OF RECOMMENDATIONS	93
APPENDIX	
28.1 Cattle and Buffalo Population in Undivided India, 1919-20 to 1944-45	103
28.2 Cattle and Buffalo Population—Indian Union 1951 to 1972	104
28.2A Average Annual Employment of Bullocks	107
28.3 Cattle and Buffalo Population—1951 to 2000 AD	108
28.4 Location, Breed and Size of Exotic Herds	110
28.5 Questionnaire asking for Information on Artificial Insemination Services (Organisational set-up, techniques, supplies and services, training of personnel etc.) in the States	111
28.6 Number of Artificial Insemination Centres, Bulls maintained and the Inseminations performed (as on 1-4-1973)	113
28.7 World Distribution of Buffaloes and their Contribution to Milk Production	114
28.8 Cattle and Buffalo Population in Andhra Pradesh, Gujarat, Haryana, Punjab and All-India—1972	115
28.9 Over three Years Female Stock and Total Population of Cattle and Buffaloes	117

CHAPTER 29—DAIRY DEVELOPMENT

SECTION	PAGE
1 INTRODUCTION	119
2 REVIEW OF PROGRESS	120
3 MARKETING	129
Present Supply-Demand Situation	129
Consumption of Milk and Milk Products	131
Consumer Preferences	134
Procurement and Transportation	134
Chilling Centres	136
Feeder/Balancing Plants	137
National Milk Grid	140
Bulk Transport of Raw Milk	141
Milk Processing	141
City Milk Supply	143
Methods for Disposing Milk in Retail Sale	144
Bottling System	144
Can Milk Distribution	145
Sachet Packing	145
Aseptic Milk Packaging	146
Bulk Milk Vending	146
Milk Powder Packets	147
Milk Supply to Rural Areas	148
Pricing of Milk and Milk Products	149
4 DAIRY PLANT MANAGEMENT	156
Government Owned Dairy Plants	156
Privately Owned Dairy Plants	158
Dairy Plants under the Cooperative Sector	159
5 MANUFACTURE OF DAIRY EQUIPMENT	162
6 PROJECTIONS FOR MILK DEMAND, PROCESSING AND MARKETING	164
7 ADMINISTRATIVE AND INSTITUTIONAL STRUCTURE	165
Evolution of Institutions at National Level	166
State Level Institutions	166
The Indian Dairy Corporation National/Dairy Development Board	167
Legal Fiscal Measures	168
8 SUMMARY OF RECOMMENDATIONS	170
APPENDIX	
29.1 Pattern of Milk Utilisation in India	174
29.2 Two-Axis Pricing of Milk	175
29.3 Pricing Effects on Procurement and Seasonal Dairy Plant Utilisation	176

CHAPTER 30—SHEEP AND GOATS

SECTION	PAGE
1 SHEEP	177
Introduction	177
Regional Distribution of Sheep	178
Sheep Husbandry Practices	179
Economics of Sheep Rearing	182
Population Estimates and Trends	183
Wool Estimates	184
Progress of Sheep Development	186
Experience with Exotic Breeds	188
Requirement of Wool	190
Breeding for Mutton Production	195
Artificial Insemination in Sheep	198
Programmes for Meeting Nutritional Requirements	200
Health Cover Programmes	202
Wool Shearing, Grading and Marketing	204
Wool Board	207
Marketing	208
Potential for Export and Import Substitution	209
Need for Increase in Number of Sheep	211
2 GOATS	211
Introduction	211
Population Trends	212
Regional Distribution	212
Goat Rearing Practices	213
Meat Production	213
Milk Production	214
Pashmina and Mohair Production	215
Need for Reduction in Number of Goats	215
3 SUMMARY OF RECOMMENDATIONS	216

CHAPTER 31—POULTRY

SECTION	PAGE
1 INTRODUCTION	222
2 POULTRY STATISTICS	223
3 DEVELOPMENT OF POULTRY FARMING	224
Pre Second World War Period	224
Post Second World War Period	226
4 BREEDING	230
Franchise Hatcheries	232
Evolving Strains within the Country	233
ICAR Research Projects	240
PL 480 Research Project on Indigenous Fowl Germplasm	243
Preservation of Germplasm	243
Random Sample Test	244
Certification of Stock	246

SECTION	PAGE
Chick Sexing	246
Broiler Production	247
Poultry Rearing under Different Husbandry Practices	248
Poultry Estates	250
Poultry Farming in Orchards	251
Poultry Production through SFDA/MFAL Projects	251
5 POULTRY FEEDS	252
Shortages and High Cost of Feed Ingredients	253
Feed Requirements	253
Total Feed Requirements	255
Feed Ingredients	256
Quality Control of Feeds	258
6 POULTRY EQUIPMENT	258
7 HEALTH COVER	259
Licensing of Hatcheries	259
8 CREDIT, COOPERATIVES AND MARKETING	260
Credit	260
Cooperatives	262
Marketing	264
9 DUCK REARING	268
Duck Farming	269
Duck Development	269
Inadequacy of Research Studies	271
Duck Development Programmes	271
10 RESEARCH AND EDUCATION	273
Research	273
Education	274
11 SUMMARY OF RECOMMENDATIONS	275
APPENDIX	
31.1 The Results of the Random Sample Tests	281

CHAPTER 32—OTHER LIVESTOCK (PIG, EQUINES, CAMEL AND YAK)

SECTION	PAGE
1 PIG	283
Population and Production Trends	284
Piggery Development During the Plan Periods	288
Present Status and Need for Piggery Development	294
Breeding	296
Artificial Insemination	298
All India Coordinated Research Project	298
Breeding Programmes for Agricultural Universities	299
Small Farmers Development Agency/Marginal Farmers and Agricultural Labourers Agency	300
Piggery Development in North Eastern States	300
Feeding	301

SECTION	PAGE
Health Cover	303
Housing and Equipment	304
Credit, Cooperatives and Marketing	305
Private Sector Pork Processing Plants	308
Quality Control	309
Training at Different Levels	309
 2 EQUINES	 310
Trend in the Change in Population	311
Types and Breeds	314
Present Utility and Future Prospects	317
Equine Development in the Past and Present	318
Development Programmes	322
Horses for Sports, Games and Pageantry	325
Preservation and Development of Indigenous Breeds of Horses	329
Stationing of Studs	331
 3 CAMEL	 332
Types of Camels	333
Population Trend	333
Breeding and Management	334
Feeding	338
Camel Diseases	338
Utility of Camel	339
Camel Development	340
 4 YAK	 341
Population and Distribution of Yaks in India	342
Usefulness of the Yak	343
Planning for Yak Development	344
 5 SUMMARY OF RECOMMENDATIONS	 345
 APPENDIX	
32.1 Imported Purebred Stock of Pigs	352
32.2 Distribution of Improved Pigs in Different States	353
32.3 Population of Horses and Ponies—1961 and 1966	354
32.4 Population of Mules—1961 and 1966	355
32.5 Population of Donkeys—1961 and 1966	356
32.6 Per cent Variation in Population of Horses and Ponies and Donkeys between 1961 and 1966 in Different Districts of Andhra Pradesh	357
32.7 Statewise Distribution of Camels in 1961, 1966 and 1972 in Different States	358

CHAPTER 33—MIXED FARMING

SECTION	PAGE
1 INTRODUCTION	359
2 REGIONAL PRACTICES	360
3 SCOPE FOR LIVESTOCK PRODUCTION IN MIXED FARMING	365
Cattle Raising	365
Sheep and Goat Rearing	366
Pig Production	366
Poultry Production	367
4 APICULTURE, SERICULTURE AND PISCICULTURE IN MIXED FARMING	367
Apiculture	367
Sericulture	368
Pisciculture	368
5 RESULTS OF STUDIES ON MIXED FARMING	369
6 BENEFITS OF MIXED FARMING	373
Need for Further Studies	375
Importance of Animal Husbandry in Special Areas	376
Local Employment Potential	377
Inclusion of Fodders in Crop Rotations	378
Quality of Livestock in Mixed Farming	379
Marketing Facilities	379
7 SUMMARY OF RECOMMENDATIONS	380

CHAPTER 34—LIVESTOCK FEEDING

SECTION	PAGE
1 INTRODUCTION	382
Present Status of Livestock Feeding	383
2 FEED REQUIREMENTS FOR LIVESTOCK	385
3 AVAILABILITY OF FEEDS	391
Fodders (Dry)	392
Concentrates of Animal and Marine Origin	396
4 REQUIREMENTS VIS-A-VIS AVAILABILITY OF LIVESTOCK FEEDS	397
Reducing the Feed Requirements	399
5 WAYS AND MEANS TO INCREASE AVAILABILITY OF FODDERS	400
Fodders	400
Trees and Shrubs as Source of Fodder	402
Silage	406
6 WAYS AND MEANS TO IMPROVE AVAILABILITY OF CONCENTRATE FEED	406
Screenings	409
Wheat Bran	409
Rice Bran	409

SECTION	PAGE
Rice Polishings	410
Other Grain Byproducts	410
Oilseeds and Oilcakes	410
Fish Oils	414
Nonconventional Feeds and Feed Additives	415
Algae	420
7 COMPOUNDED FEED MANUFACTURING INDUSTRY	421
8 FURTHER SUGGESTIONS	423
9 SUMMARY OF RECOMMENDATIONS	427
APPENDIX	
34.1 Average Rates of Feeding of Concentrates Green and Dry Fodder Assumed for Different Categories of Livestock and Poultry	433
34.2 Estimated Requirements of Feeding Stuffs for Some Categories of Livestock in 1973	434
34.3 Availability of Non-edible Oil Cakes	435
CHAPTER 35—ANIMAL HEALTH	
SECTION	
1 INTRODUCTION	436
2 CLINICAL AND PREVENTIVE VETERINARY MEDICINE	438
Veterinary Dispensaries/Hospitals	438
Disease Investigation and Diagnostic Laboratory Service	442
Special Organisation for Exotic Diseases	443
3 REGISTRATION OF VETERINARIANS	444
4 VETERINARY BIOLOGICAL PRODUCTS	447
5 CONTROL OF ANIMAL DISEASES	450
Rinderpest	451
Foot-and-Mouth Disease	455
Tuberculosis	457
Brucellosis	460
Mastitis	461
Haemorrhagic Septicaemia (Pasteurellosis)	462
Anthrax	463
Black-quarter	464
Contagious Bovine Pleuro-Pneumonia	465
Fascioliasis (Liver fluke disease)	466
Warble Flies	468
Theileriasis	468
Sheep Pox	469
Rabies	470
Swine Fever (Hog cholera)	471
Ranikhet Disease	472
Marek's Disease	473
Chronic Respiratory Disease (Avian respiratory mycoplasmosis)	475
Pullorum Disease	476
Duck Virus Hepatitis	477
Deficiency Diseases	478
Other Important Diseases	478

SECTION	PAGE
Implementation of Disease Control Programmes	479
6 LEGISLATION FOR CONTROL OF ANIMAL DISEASES	479
7 ANIMAL QUARANTINE AND CERTIFICATION	481
Quarantine	481
Certification	482
Pre-export Quarantine	483
8 ANIMAL DISEASE INTELLIGENCE SERVICE	483
9 VETERINARY PUBLIC HEALTH	486
10 SUMMARY OF RECOMMENDATIONS	488

CHAPTER 36—MEAT PRODUCTION AND ANIMAL BY PRODUCTS

SECTION	PAGE
1 MEAT PRODUCTION	499
Production and Demand for Meat	499
Impediments to Modernisation	503
Processed Meat	504
Problems of Marketing	504
Export Trade of Meat	505
Improvement of Meat Industry	506
2 ANIMAL BYPRODUCTS AND ANIMAL WASTES	507
Hides and Skins	508
Bones	511
Animal Fats	512
Bristles	512
Blood	512
Goat Hair	513
Horns and Hoofs	513
Meat Unfit for Human Consumption	514
3 UTILISATION OF FALLEN ANIMALS	514
Economic Loss	515
Carcass Utilisation Centres	515
4 SUMMARY OF RECOMMENDATIONS	516

APPENDIX

36.1 Cost Estimates and Economic Feasibility for Setting up Modern Abattoirs of Three Different Sizes	521
36.2 Location of the Modern Bacon Factories under Public Sector, Their Installed Capacities and Present Produc- tion Level	525
36.3 Livestock Market in Bombay—A Study	526
36.4 Estimate of the Cost of Setting up a Flaying Platform and a Carcass Utilisation Centre	530



सत्यमेव जयते

CATTLE AND BUFFALOES

1 INTRODUCTION

28.1.1 India has the largest cattle and buffalo population. There are about 179 million cattle and 58 million buffaloes in the country (1972). About one-sixth of the cattle and about half of the buffalo population of the world are in India.

28.1.2 Cattle and buffaloes occupy a pivotal position in the national life. In many ways cultural life in India, especially in the countryside, is intimately connected with these animals. This is particularly so with the cattle. The contribution of the cattle and buffalo to the national economy is indeed vast. They are the main source of draught power in agricultural operations and rural transportation. They provide essential foods of animal origin like milk and meat. Large quantities of animal byproducts such as hides, bones, blood, guts, etc. and valuable organic manure are also provided by these animals. For many years to come the bullock and buffalo will continue to be the mainstay of agricultural operations, particularly for the small and marginal farmers. Even in future, despite the impact of modernisation, a large proportion of motive power for rural transportation will be bullock based. As cattle and buffalo raising involves intensive use of labour usually on the part of the members of the family, more than many other enterprises, it offers very significant employment and income opportunities to small and marginal farmers and agricultural labourers. A very large proportion of the female labour force finds scope for fuller utilisation in several operations connected with cattle and buffalo rearing.

28.1.3 The diet of an average Indian comprises 51 g of protein per day. In the case of vegetarians milk is the only source of animal protein while meat-eating people obtain about 4 per cent of the total protein content of the diet from milk and milk products. Against this in almost all developed countries 62 per cent of protein in the diet comes from animal source and about half of this from milk and milk products. Proteins of high biological value are derived mainly

from animal sources, and these are essential for growing children, expectant and nursing mothers, old and the infirm, and heavy manual workers. The Nutrition Expert Group of the Indian Council of Medical Research has recommended 300 g of milk for pre-school children, 250 g for school children in the age group of 7—12 years and for boys and girls from 13—18 years of age, and 200 g for adult men and women and an additional 125 g for expectant mothers. These recommendations are for vegetarian population. For meat-eating population the recommended requirements range from 200 g for children to 160 g for adults. The minimum nutritional requirement recommended per head/day is about 201 g¹ of milk against the availability of only 110 g in 1973-74.

28.1.4 Although India possesses an enormous cattle and buffalo population, the annual milk production is at present (1973-74) only 23.2 million tonnes—a very low figure indeed. The average annual milk yield per cow is only of the order of 157 kg and of buffalo 504 kg. In many countries where dairy development has made significant progress such as Denmark, UK, New Zealand and USA, the average annual milk production per cow is 3000-4000 kg. The low milk production in India is due to extremely low production potential of the animals and lack of adequate nutrition and health coverage. Only two-thirds of the fodder and one-fourth of the concentrates required for providing adequate nutrition to the present animal population are produced in the country. Consequently, most cows and she-buffaloes, dry as well as wet and youngstock are underfed in most of the States of India. The large gap between requirements and availability of milk and milk products can be bridged by an aggressive cattle and buffalo development programme, comprehensively organised and efficiently implemented.

28.1.5 In the past, cattle and buffalo rearing was a way of life and did not receive any special attention. The current inadequacy in the quality of stock, feeds and fodder and health protection facilities are the result of past neglect. It is a paradox that while cow is treated with reverence, she is not properly cared for.

28.1.6 Our examination indicates tremendous potentiality for cattle development in India in the overall plans for rapid economic growth and desirable social changes. If cattle and buffalo development programmes are pursued with vigour, the commodities available from these animals will in future meet not only the increasing domestic demand but promote possibilities for export and import substitutes. This will greatly enhance the scope for income and employment in

¹ Sukhatme P.V. 1970. Nature of Protein Problem and its implications for Policy measures—Paper presented at National Food Congress, New Delhi.

rural economy. This chapter furnishes a review of the development in the past, assesses the current position and discusses the future possibilities in this respect.

2 TREND IN CATTLE POPULATION

28.2.1 The trend in cattle population has been studied on the basis of livestock census data which we have considered separately for the periods prior to and after Independence. This was necessary as direct comparison of the pre-Independence with post-Independence period would be misleading. Large areas that went to Pakistan differed not only in agricultural practices and climatic conditions but also in cultural traditions. For the census period 1919-20 to 1945 figures in respect of only the British Provinces have been taken into consideration as participation of the then Princely States in census enumeration was not regular.

28.2.2 Pre-Independence period : The number of cattle and buffaloes under different broad classifications enumerated from the first to sixth Livestock Censuses are given in Appendix 28.1. It would be observed that there had been a small but progressive increase in the number of male and female cattle from the year 1919-20 to 1929-30. The number of animals in each of the categories as well as of total cattle showed a progressive decrease between 1934-35 and 1944-45. There was a small but steady increase in the total buffalo population upto the year 1934-35. Thereafter there was a slight decline. The number of she-buffaloes, however, maintained a steady rise right upto 1945, registering an increase of about 4.5 million over 1919-20 population.

28.2.3 Post-Independence period : The number of cattle and buffaloes under different classifications as enumerated in the Seventh to Eleventh Livestock Censuses is given in Appendix 28.2. The following trends in the population of different categories of cattle and buffaloes were observed during the period 1951—72.

- (i) Working animals : There was an increase of 14.26 million (24.4 per cent) in the number of bullocks and 1.61 million (26.7 per cent) in the number of male buffaloes used for work.
- (ii) Breedable cows and she-buffaloes : There was an increase of 7.35 million (15.8 per cent) in the number of cows and an increase of 7.9 million (37.6 per cent) in the number of she-buffaloes.

- (iii) Youngstock : There was an increase of 3.89 million (8.9 per cent) in the number of youngstock of cattle and 5.52 million (37.5 per cent) in the number of youngstock of buffaloes. The increase was both in the male and the female youngstock.

28.2.4 It becomes evident from the above data that there has been a progressive increase in all classes of cattle and buffaloes since 1951 onwards. While this increasing trend in cattle and buffalo numbers may be attributed to increased agricultural requirements, demand for milk and milk products and other economic reasons, we consider it necessary to examine whether it was advisable that this increasing requirement should be allowed to be met primarily by increase in the number of animals rather than through effecting improvement in the productivity and better utilisation of stock. As a matter of fact, the stagnancy in the quality and productivity of the bovine stock in the country during the last two decades, in spite of developmental efforts undertaken has been noted with great concern by all engaged in this field of development. There is a view held by almost all who had examined this problem of livestock numbers in the country that deterioration in the quality of livestock in general and of cattle in particular is attributable to the presence of large numbers compared to the available resources of feeds and fodder. We have discussed the inadequacy of feeds and fodder in the country and measures to augment their supply in Chapter 34 on Livestock Feeding and Chapter 25 on Fodder Crops.

28.2.5 The Royal Commission on Agriculture (RCA) studied the quality and number of livestock in the country and their relationship with the land utilisation pattern and the availability of feeds and fodder. The RCA concluded that the large number of cattle and bullocks in the country was the result of operation of a vicious circle in which low working efficiency in bullocks was being compensated by attempts at increasing their number. In areas, where the conditions for rearing efficient cattle were poor, there was a tendency to keep greater number of animals. The RCA was of the view that it might be possible in India to reduce the number of working bullocks without necessarily reducing the existing standard of cultivation provided an improvement in the working efficiency of cattle was effected through better feeding and breeding.

28.2.6 The position in respect of working animals (both male and female) among cattle and buffaloes, total cropped area and number of operational households over the period 1951—72 are given in Table 28.1.

It will be seen from Table 28.1 that the number of working animals

has increased over the years along with an increase in the gross cropped area. The gross cropped area works out to 3.91 ha per pair of bullocks in 1951 and 1961 and 4.16 ha in 1972. The increase in the number of bullocks could be attributed to the increase in the area under cultivation, intensity of cropping and perhaps to some extent to adoption of intensive agricultural practices for augmenting yield per acre. The eighth round (1954-55) and the sixteenth round (1960-61) of the National Sample Survey showed that the average size of household operational holdings was 5.43 acres in 1954-55 and 5.12 acres in 1960-61 indicating that the size of holdings continued to remain small. As the agro-institutional situation has remained the same over the years there had been little scope for reduction in the number of bullocks in the country. According to the All-India Agricultural Census, 1970-71, the number of operational holdings was about 70 million.

TABLE 28.1

Working Animals, Total Cropped Area and Number of Operational Households

Year	Work- ing bul- locks (000)	Work- ing cows (000)	Work- ing he- buffa- loes (000)	Work- ing she- buffa- loes (000)	Total work- ing animals (000)	Total gross cropped area (000 ha)	Area per pair of tional bullo- cks (ha)	No. of opera- tional hold- ings
1	2	3	4	5	6	7	8	9
1951	58,475	2,315	6,028	550	67,366	131,898	3.91	
1961	68,704	2,150	6,645	487	77,985	152,716	3.91	49,874
1972	70,656	2,101	6,999	381	80,137	167,412*	4.16	NA

(*1970-71)

Source : (i) Columns 2—6 : Livestock Censuses 1956, 1961, 1966 and 1972.

(ii) Indian Agriculture in Brief—Thirteenth Edition March 1974.

28.2.7 The maximum area of land which can be cultivated by a pair of bullocks will not only depend on the work efficiency of the bullocks and size of holdings but also on such factors as the period available for cultivation, nature of soil, crops grown and timely handling of each stage of operation. Conversely, for any assessment of the actual requirements of bullocks, it will be necessary to have information on the number and size of holdings, number of work cattle owned by different sized farms and draught efficiency of bullocks. No specific studies have so far been conducted for this type of assessment. However, some broad inferences could be drawn from the Farm Management Studies¹ carried out in selected districts in different States at

¹ Farm Management Studies under the auspices of the Directorate of Economics & Statistics, Union Ministry of Agriculture & Irrigation. Studies carried out during the years 1954 to 1959.

various points of time. These studies show that the average area covered by a pair of bullocks is less in smaller holdings. As such a larger number of bullocks are maintained per unit area in States where small sized holdings are the rule.

28.2.8 Another important consideration is in regard to the extent of utilisation of bullock power. The data obtained from studies on Economics of Farm Management have been presented in Appendix 28.2A which show the extent of under-utilisation of bullock power in general in the country. The conditions in regard to utilisation of bullocks in different States are different ; the utilisation of bullock power, on an average, is 15.9 per cent in West Bengal, 16.95 per cent in Orissa, 23 per cent in Madhya Pradesh, 37.3 per cent in Punjab and 44.7 per cent in Uttar Pradesh. It will thus be seen that the vicious circle as pointed out by the RCA operating in regard to number and efficiency of bullocks still continues to be a drag on the economy of the farmers, particularly of the small holders. If the potential productivity of animals could be fully exploited, India could meet her draft power needs with a far less number of bullocks. Consequently, less number of cows would be needed to be raised for producing the required number of bullocks. With better breeding and better feeding the same quantity of milk would continue to be produced with reduced number of cows. Massive efforts for improvement of cattle in all parts of the country both for milk production and work efficiency are, therefore, called for. This could be attempted either by grading up nondescript cattle with the improved indigenous breeds or through crossbreeding with exotic dairy breeds. Bullocks thus produced would invariably be larger in size and more efficient in work. With an improvement in efficiency, lesser number of bullocks will be required. These are, however, long term measures and may not make any immediate impact on the number of bullocks in the country. Under the existing farming conditions, we feel that the existing stock of working animals is actually required at present. On this assumption the number of cows that will be necessary to produce the working animals for replacement every year will depend on two parameters, namely, the breeding efficiency of cows and the mortality among the youngstock.

28.2.9 The percentages of cows and buffaloes giving birth to a calf in a year, in the country as a whole on the basis of the Livestock Census 1972, work out to about 40 and 50 respectively. These percentages have more or less remained constant since 1951. In our opinion, there is a large scope for improving the breeding efficiency of the cows and buffaloes through better feeding and management

practices and by providing an efficient health cover.

Mortality among Youngstock

28.2.10 The figures relating to youngstock of different age groups and the number of cows/buffaloes in milk in a year as enumerated in the Livestock Censuses carried out in 1951 to 1972 have been analysed to obtain some broad indications regarding calf mortality. The figures for cattle youngstock below one year (male and female) compared with the number of cows in milk show that there is not much loss due to mortality and other causes in this age group. However, a comparison of the youngstock below one year with youngstock between one to three years indicates that there is heavy loss of youngstock after they attain the age of one year. This may be due to neglect in feeding youngstock once they are weaned. There is little difference observed between mortality amongst male and female youngstock. In the case of buffalo calves there is, however, very heavy mortality both during their first year of life and later. The loss is comparatively higher in the males reflecting wilful neglect of these animals. The heavy loss in youngstock can be mainly due to poor feeding conditions because of inadequate resources with the farmers to produce sufficient quantities of fodder to feed a large number of youngstock. Therefore, if mortality in the male youngstock could be brought down the number available for replacing bullocks would be almost double every year.

Problem of Excessive Cattle and Buffalo Population

28.2.11 We have referred earlier to the progressive increase in the number of cattle and buffaloes since 1951 onwards without a corresponding increase in the feeds and fodder availability. The foregoing analysis also shows that there has been a large increase in the number of bullocks in particular and corresponding increase in cows to produce more bullocks. In short, the vicious circle causing the degeneration in the quality of cattle identified by the RCA has been perpetuated. We feel that it is worthwhile to draw attention to this problem at this stage and indicate the possible measures that could be taken to remedy this situation.

28.2.12 Assuming that a period of 10 years is the average working life for bullocks from age of maturity which may be between three to four years, about 10 per cent of the working bullocks in the country will have to be replaced every year. On the assumption that the

breeding efficiency of cows is only 45 per cent (which is a weighted average of the ratios of cows in milk to total number of breeding cows for different States and Union Territories) and the annual replacement of bullocks required is 10 per cent, it may be estimated that there were 33 per cent surplus cows in 1972. Even if the loss in male calves between 1 to 3 years of age could be reduced by about 25 per cent and the breeding efficiency in cows improved only by about 10 per cent through better feeding, animal health cover and management practices, the surplus cows would further be raised by another 30 per cent. The above position has been brought out mainly to show that at present there are in the country more cows than needed to meet the requirements of bullocks and that there is heavy demand on the available feeds and fodders which are in short supply.

28.2.13 The approach to cattle development in the successive Five Year Plans, briefly reviewed later in this chapter and recommended by us for the future, envisages massive programmes for better breeding of cattle and buffaloes to improve their reproductive and productive efficiency. These programmes would help in the production of progressively larger number of improved cows and she-buffaloes. In the case of cows, extensive crossbreeding with exotic dairy breeds is envisaged in order to produce crossbred cows with increased milk production potential in order to rapidly bridge the gap between the demand and availability of milk by the turn of the century. We have discussed later in Section 17 that by 2000 AD about 30 million improved cows and about 18 million improved buffaloes would become available through intensive cattle development programmes. It may be estimated that on an average about 2.5 million improved cows and she-buffaloes would be produced annually upto 1985 and about 3.5 million later on. If these high producing animals are to be properly fed and reared to obtain satisfactory level of production, it would be necessary to ensure that low producing stock is eliminated. Otherwise, it would be well-nigh impossible to provide adequate feeds and fodder for the high producers. In other words, increase in the number of high producing cows and buffaloes should not add to the population but replace at least equal number of inferior stock, if not more. We have already mentioned that milk production in the country even at present could be maintained by a smaller number of cows provided adequate feeds and fodders are ensured. This will become all the more relevant in the future when we anticipate a larger number of improved cows and she-buffaloes with higher production potential. Unless adequate feeding levels are ensured, these animals cannot be expected to produce upto their genetic potential and the gap between the milk demand and its production cannot be narrowed

down.

28.2.14 We have considered the ways and means of not only preventing the problem of enormous numbers of cattle and buffaloes getting accentuated but also of reducing their number to the extent possible. In any effort in stock improvement, the primary attempt should be to select animals taking into consideration the facilities available for providing adequate feeding, proper management and animal health cover. Selection of animals naturally implies simultaneous culling of below standard animals. If full benefits are to be obtained through selection, it should be ensured that culled stock are not allowed to compete with the better stock in respect of feeding, housing and management facilities and are eliminated. The farmers helped to produce high yielding cattle and buffaloes have already begun to appreciate the importance and economic benefits of reserving available feeds and fodders for improved stock and eliminating the low producing animals. Such a replacement of low producing stock by high producers is noticeable to a limited extent in some milkshed areas. Intensive measures taken up for assisting farmers to produce more and more good quality stock backed with technical advice and economic incentives may increasingly induce farmers in other areas also to retain improved livestock and cull and eliminate uneconomic producers. The conventional method of elimination of culled stock in other countries is through slaughter. In India, disposal of cows and she-buffaloes through slaughter might be possible only in some of the States but there are certain legislative restrictions in others.

28.2.15 Taking into consideration the various constraints in adopting rigorous culling and disposal of cows and she-buffaloes, we have tried to project figures in respect of the various categories of cattle and buffaloes in time perspectives upto 2000 AD vide Appendix 28.3. While arriving at these figures we have taken into consideration the level upto which the production of livestock feeds and fodders could be augmented as detailed in Chapters 25 and 34 on Fodder Crops and Livestock Feeding respectively. We have taken into consideration the requirement of bullock power as discussed in Chapter 50 on Farm Power as well as the projected demands for milk and milk products. It is anticipated that although the cattle and buffalo population has almost reached a point of saturation at present it will continue to increase at a slow rate upto 1980. If various measures for increasing quality stock and disposal of surplus low quality animals are taken on hand earlier, the trend in increase of cattle and buffalo population may be expected at the most to be contained by the year 1985. This is on the assumption that there would be some time lag during which the various development programmes including measures for

reduction in stock would start making impact. It would be necessary to ensure that the trend of future cattle and buffalo population in the country should show increase in the proportion of improved types with overall reduction in the total numbers. We have discussed in Section 17 the future programmes and policies for rapid development in the quality and productivity of cattle and buffaloes. If the pace of replacement of low producing stock by improved cows and she-buffaloes as recommended by us is maintained, it would be possible to effectively bridge the gap between demand and production of milk during the years 1985 to 2000 AD even with the reduced number of total milch stock.

28.2.16 The matter concerning deterioration in the quality and productivity of cattle has received the attention at expert, administrative and political levels with varying degrees of emphasis on policies as well as programmes. Since the advent of planning, a number of cattle development projects have been launched. Before discussing future action, we consider it worthwhile to briefly review the changes in policies on cattle development and the progress made under a few of the major cattle development projects since the submission of the Report by the RCA.

3 ESTIMATES OF MILK PRODUCTION AND THE DEMAND PROJECTIONS

28.3.1 Estimates of milk production have been made by various agencies ^{1,2,3} at different times based on the number of livestock obtained through the livestock census and data on average calving interval, lactation period and lactation yield per animal based on random sample surveys and other market surveys. The first attempt at estimation of milk production was made by the Directorate of Marketing and Inspection in 1940. Since no objective procedures were adopted the estimates were not representative and did not, therefore, reflect the real picture. The procedures adopted by various agencies and the deficiencies therein have been discussed in Section 8 of Chapter 61 on Statistics.

28.3.2 The Central Statistical Organisation (CSO) prepared the estimates of milk production in connection with the estimation of national income which were accepted for official purposes. These are given in Table 28.2.

1 Report on the Marketing of Milk of Directorate of Marketing and Inspection, Government of India for the years 1940, 1945, 1950 and 1956.

2 Chowdhary, R.K. and Narang, K.L. 1962, Milk Production, Its Technique of Estimation, Agricultural Situation in India 17 No. 2.

3 Statistical Abstract India 1970 New Series 18, CSO, Department of Statistics, Cabinet Secretariat.

28.3.3 Estimates of milk production based on objective methods have not been available in the past as the recording of milk was not practised by even the progressive farmers. However, limited data on milk production are available in Government farms, some organised private farms, dairy research institutes, university farms and others where milk yield of each animal is recorded. Since these data relate to comparatively better type of animals kept under improved conditions of feeding and management, these cannot be used as indicators for evaluating productivity of cows and buffaloes maintained by an average farmer.

TABLE 28.2

Production of Milk in India¹

Year	(in '000 tonnes)			
	Cow milk	Buffalo milk	Goat milk	Total
1	2	3	4	5
1940	7,517	9,090	502	17,109
1945	7,698	9,778	498	17,974
1951	7,743	9,184	479	17,406
1956	8,180	10,976	561	19,717
1961	8,753	11,087	531	20,375
1966	6,918	11,879	571	19,368

28.3.4 The need for obtaining reliable estimates of production of milk for assessing the contribution of livestock products to the national income and the progress being made under the development programmes has been realised. We understand that integrated surveys for estimation of milk and other livestock products are proposed to be carried out simultaneously in all the States under the Fifth Plan and that the all India estimate of milk production will be built up on the basis of State estimates. It is essential that all the States should carry out the integrated surveys simultaneously.

28.3.5 It was anticipated that production of milk would reach a level of 25.86 million tonnes by the end of Fourth Plan period i.e. 1973-74. However, in the draft Fifth Plan it has been indicated that the estimated milk production was only 23.20 million tonnes in 1973-74 which worked out to 110 g per capita per day. According to the nutritional needs of milk as given in paragraph 28.1.3 it will be observed that there is a wide gap between the availability and the requirements.

28.3.6 Projections of gross demand of milk for the years 1985 and

¹ Statistical Abstract India 1970 New Series 18, CSO, Department of Statistics, Cabinet Secretariat.

2000 AD have been given in Chapter 10 on Demand Projections. The projections of daily per capita and gross demand for milk on the basis of low and high estimates and in respect of rural and urban areas for 1985 and 2000 AD are reproduced below :

	1971				1985			2000 AD		
	Rural	Urban	Total		Rural	Urban	Total	Rural	Urban	Total
Indices* of per capita demand	100.0	100.0	100.0	Low	113.27	124.23	—	125.38	146.34	—
				High	151.98	158.72	—	167.11	183.53	—
Projections of gross demand (million tonnes)	16.87	4.84	21.71	Low	23.97	9.40	33.37	31.81	17.55	49.36
				High	32.16	12.01	44.17	42.39	22.01	64.40

It will be seen from the above that milk yield is required to be increased from the present level of about 21.70 million tonnes to about 44.17 million tonnes by 1985 and 64.40 million tonnes by 2000 AD to meet the huge demand of fast increasing human population. It may appear that it will be well-nigh impossible to achieve this much increase in milk production. We would, however, like to say that the increase in milk production as proposed by us is technically attainable as discussed in Chapter 29 on Dairy Development. We would, however, like to emphasise that for achieving the target of milk production, it would be absolutely essential to expeditiously implement the programmes proposed by us for bringing about an all round improvement in the genetic quality of the indigenous stock, their maintenance in sound health and provision for proper feeding to enable them to portray their genetic potentiality. Proper incentives will also have to be given to the milk producers to encourage them to enhance milk production. These programmes have been outlined in this chapter as well as in Chapters 25, 29, 34 and 35 on Fodder Crops, Dairy Development, Livestock Feeding and Animal Health respectively.

4 CATTLE DEVELOPMENT

Review

28.4.1 There are a number of fine breeds of cattle available in the country that could provide good foundation stock for initiating cattle development programmes. The RCA drew special attention to this fact in its report. The RCA was of the opinion that rearing of

* Base : 1971 = 100.

bulls would not be remunerative for the farmers. The Government should, therefore, undertake the expensive but essential work of building up herds of pedigree cattle for production of superior bulls in large numbers. The establishment of cattle breeding farms for cattle development thus, formed an important part of the earlier activities of the Animal Husbandry Departments. In 1938-39, there were 53 cattle breeding farms which were mostly concentrated in the northern Provinces. Taking note of some success in the formation and functioning of cooperative cattle breeding societies in Punjab, and similar prospects in Bombay, the RCA recommended that where cultivators evinced keen interest in their livestock, organisation of cooperative breeding societies should be encouraged. This could be done by loan or gift of a bull and/or by the provision of grazing grounds on favourable terms. As a consequence of this recommendation, some State Animal Husbandry Departments made efforts to organise such societies. Another important and major contribution during the late thirties and early forties in the field of cattle development was the laying down of description and definition of characteristics of different breeds of cattle and buffaloes by the then Imperial Council of Agricultural Research.

28.4.2 In dealing with the problems involved in cattle breeding in rural areas, the RCA felt that even though cattle breeding was being given some attention, little progress was evident judging from the small number of bulls supplied. It emphasised that available bulls from the Government farms should be used to raise superior quality stock in selected areas where improved strains could be multiplied for distribution. As the number of pedigreed bulls produced at the Government farms was very small as compared to the requirements, the State Governments adopted the system of distribution of approved bulls from sources other than Government farms. Purchase of bulls from breeding tracts was effected and that gave some stimulus to improved breeding by progressive cattle breeders. This method was the cheapest and a large number of bulls could be obtained particularly for grading up of nondescript cattle. As a result of this policy, the number of pedigreed and approved bulls increased in rural areas. Little impact could, however, be made in changing the type and production of stock excepting in limited pockets as controlled breeding was not practised. Moreover, timely replacement of bulls was not ensured. Another serious obstacle to cattle development in rural areas was the presence of a large number of scrub bulls. Farmers were reluctant to get their youngstock castrated as it was feared that such a practice would adversely affect the growth of male calves into good bullocks. Cast-

ration of scrub bulls was carried out by the State Veterinary Departments but regular periodical castration campaigns were not properly organised. Thus, lack of continuity in replacement of bulls and failure to eliminate nondescript young bulls from the areas where high quality bulls were introduced largely nullified cattle development programmes.

Approach under Five Year Plans

28.4.3 During the First Five Year Plan the Key Village Scheme was the main plank for cattle development. *Gosadan* Scheme was also initiated during this Plan period for removal of useless cattle to areas of natural grazing or to tracts where available fodder was remaining unutilised. Another important project that was initiated was the *Gaushala* Development Scheme for developing gaushalas into centres of economic milk production. It was, however, observed that animal husbandry developmental plans suffered from several limitations, such as a larger population of livestock than the land could properly support, an enormous number of unproductive cattle, acute shortage of feeds and fodders and great paucity of superior quality breeding bulls. The breeding policy during the First and the Second Plans was to develop dual purpose breeds which could provide good bullocks and increased quantities of milk. As an experimental breeding programme, it was also decided to undertake crossbreeding in high altitude and/or heavy rainfall areas using bulls of exotic breeds. A farm with a herd of Jersey cattle was set up in Kataula, Himachal Pradesh to meet the requirement of Jersey bulls for the crossbreeding projects. The need for registration of cattle conforming to certain prescribed standards in the main breeding tracts was recognised as an important means for development of cattle breeds. Accordingly, a scheme to organise breeders' societies for registration of cattle, milk recording and supply of breeding stock of Haryana, Gir and Ongole breeds of cattle and Murrah breed of buffalo was initiated. In the Third Plan a scheme for progeny testing was started with Haryana cattle and Murrah buffalo at Hissar. During the later half of the Third Plan period it was realised that cattle development programmes started in the earlier Plans could not make much impact on improvement of stock due to lack of sufficient inputs and absence of tie up of the production programmes with proper marketing systems. An area development approach for cattle development popularly known as Intensive Cattle Development Project (ICDP) was, therefore, formulated as a part of the Special Development Programme. A new cattle breeding policy was evolved according to which crossbreeding was introduced in areas covered by ICDP and Key Village blocks that lay

in the milksheds of dairy projects.

28.4.4 On the eve of the Fourth Plan, it was decided to set up six large cattle breeding farms for some selected milk breeds of cattle and buffaloes for undertaking selective breeding and progeny testing of bulls. Each of these farms was to have a foundation stock of 300 cows/heifers. Three large Central Cattle Breeding Farms at Suratgarh (Rajasthan) for Tharparkar breed, Chiplima (Orissa) for Sindhi breed and Ankaleswar (Gujarat) for Surti buffaloes were set up. Work on two more Central Farms at Koraput (Orissa) for Jersey breed and Alamadhi (Tamil Nadu) for Murrah buffaloes was initiated. During the Fourth Plan period, a coordinated cattle breeding programme based on selection and progeny testing of bulls was also started in nine Government Farms in the States.

28.4.5 Another scheme was started in 1963 by the Indian Council of Agricultural Research (ICAR) at Haringhata, West Bengal for evolving a new breed of dairy cattle by crossing grade Haryana cows with Jersey bulls. This scheme was merged in 1968 with a more comprehensive project supported by United Nations Development Programme, PL 480, Central Government and Food and Agriculture Organization of the United Nations. This programme included three exotic breeds, Holstein Friesian, Brown Swiss and Jersey with 1,500 grade Haryana type cows.

28.4.6 A Coordinated Research Project on Cattle Breeding was also started with the objective of evolving a breed of dairy cattle by crossing indigenous cows with bulls of exotic superior dairy breeds that would have reasonable adaptability to local environments and high breeding efficiency. A central frozen semen bank was set up at Hessarghata (Karnataka) for collection, processing, storage and transport of frozen semen. With a view to intensifying crossbreeding work in selected ICDPs, four more frozen semen stations were set up at Amristar, Gurgaon, Indore and Bangalore with assistance from Danish Government. Considering the contribution of buffaloes to milk production, an All India Coordinated Research Project on Buffaloes was also started by the ICAR.

28.4.7 The approach to cattle and dairy development projects in the Fifth Plan emphasized the need for extending the facilities to the farmers for improved breeding of their stock and to provide adequate fair price for their produce through organised marketing system. As recommended in our Interim Report on Milk Production Through Small and Marginal Farmers and Agricultural Labourers (hereinafter referred to as the Interim Report on Milk Production), dairy cattle rearing was recognised as an instrument to bring about social change to improve the economy of small and marginal farmers and agricultural

labourers. An aggressive crossbreeding programme aiming at a target of 5.7 million inseminations per year was laid down. For achieving this objective, imports of frozen semen, breeding bulls and foundation female stock of exotic breeds were proposed. It was decided that the number of exotic cattle breeding farms should be increased from 25 to 35, and 50 more ICDPs should be established in the milk-sheds of the existing and new dairy projects. In addition, large sized integrated cattle-cum-dairy development projects were proposed to be taken up around milk supply schemes in cities like Kanpur, Bangalore, Bhopal, Nagpur, Hyderabad and Jaipur, on the lines of milk production enhancement and marketing programmes taken up under the Operation Flood Project described in Chapter 29 on Dairy Development. The programmes and the progress made under some of the major cattle development projects initiated during the Five Year Plans are briefly reviewed in the following paragraphs bringing out the salient achievements as well as constraints under which they had to function.

All India Key Village Scheme

28.4.8 The basic objective under the Key Village Scheme was the multiplication of superior germplasm from the established farms in selected compact areas in breeding tracts. The scheme envisaged a multifaceted approach to cattle development by giving simultaneous attention to better breeding, improved feeding, effective disease control measures, scientific management practices and organised marketing facilities. By the time the Key Village Scheme was finalised for implementation on all India basis under the First Plan, the utility and feasibility of adopting AI technique in cattle breeding had been established. It was, therefore, decided to include AI as an integral part of the technical programme. The original intention was that Key Village centres should be established only in breeding tracts so that the pedigree bulls from the farms might be used intensively for breeding and that the progeny should be distributed in other areas for extensive grading up to improve quality and production of the stock there. But as the scheme progressed, centres were also set up in the States which had no recognised breeds, and even in areas of nondescript cattle in the States which had tracts of purebred and improved cattle. Thus, this scheme which was in essence conceived mainly for stud bull production started functioning as a programme for general development of cattle both in the breeding tracts and in areas of nondescript cattle. During the First Plan 146 Key Village blocks were established. Under the Second, Plan the scope and the functions of the scheme were expanded

and 197 new Key Village blocks and 64 urban AI centres were started.

28.4.9 An Expert Committee was set up in December, 1959 by the Government of India to review and evaluate the work done under the Key Village Scheme and to make suitable recommendation for formulating the future programme¹. The Committee suggested that the State Governments should examine the functioning of the Key Village blocks with a view to improving their work and close down such of the blocks as had not produced satisfactory results despite being in existence for a number of years. To overcome the shortage of superior bulls the Committee recommended that the State Governments should formulate in advance bull purchase programmes in coordination with the States having extensive breeding tracts. It was also suggested that the programme for rearing of bull calves in the Key Village areas should be expanded, and to achieve satisfactory breeding control in the Key Villages castration programme should be intensified. Special attention was drawn to the fact that feed and fodder development programmes had not made satisfactory progress. The Committee suggested ways and means for better utilisation of the existing fodder resources and improvement in village pasture lands. The need to organise marketing of livestock and livestock products through cooperative societies of cattle owners was also stressed. The Committee also made a number of proposals for improvements in the organisation of artificial insemination (AI) centres.

28.4.10 On the basis of the findings and recommendations made by the Committee establishment of centralised semen collection centres and expansion of area under Key Village blocks in specific breeding tracts, in-service training of staff, subsidised rearing of calves, establishment of marketing cells to promote marketing facilities were included in the Third Plan. Under the Fourth Plan it was emphasised that all inputs for integrated cattle development programme should be provided under Key Village Scheme and that the scheme be implemented on the same lines as the intensive Cattle Development Projects though on a small scale.

28.4.11 By the end of the Fourth Plan 583 Key Village blocks were functioning. During the Fifth Plan period, some of the Key Village blocks are proposed to be merged with the new ICDPs and with the milk production enhancement programmes of the Operation Flood Project (OFP) and additional 100 Key Village blocks would be set up in the areas which would not be brought under the ICDP or OFP.

¹ Report of the Committee on Key Villages. 1961. Ministry of Food & Agriculture, Government of India, New Delhi.

28.4.12 As stated in paragraph 28.4.8 the Key Village Scheme which was at first conceived as a programme to meet the shortage of breeding bulls gradually transformed into a basic programme for general cattle development in rural areas. The scheme was considerably expanded during the first two Plan periods when the Government of India was sharing expenditure with the States. During the Third Plan, the scheme was transferred to the State sector and direct financial assistance to this scheme from Government of India was discontinued. This change in the financial allocation pattern affected to a large extent the provision of adequate inputs and services. The various reviews made on this scheme in recent years showed that important items of work such as feed and fodder development and cooperative marketing of milk were not being attended to and for want of sufficient budget provision even the equipment and other requirements for AI were not made available adequately.

28.4.13 Considering the fact that about 600 Key Village blocks are functioning at present catering to progressive development in productivity of nearly six million breedable cow and she-buffalo population and quite sizeable investments have been made in this project, this scheme deserves much more importance and attention than what it receives currently at the hands of both the Central and State Governments. As stated in paragraph 28.4.8, the Key Village centres in the areas that come under the ICDPs or OFP or the proposed integrated cattle-cum-dairy development projects would automatically merge with those projects. Still there would be a large number of Key Village blocks functioning in other areas. These would fall broadly under two categories namely those falling under the milksheds of smaller dairy projects and those located in breeding tracts of indigenous breeds. In our opinion the general objective of the Key Village blocks falling under the former category should be one of development of cattle and buffaloes with particular emphasis on production and marketing of milk. The breeding policy in these blocks should be grading up of cattle with improved indigenous breeds or crossbreeding with exotic dairy breeds, depending upon the level of husbandry, health cover, market for milk and other conditions prevailing in these areas. In the case of key village blocks lying in the breeding tracts, a few selected indigenous breeds which have potentialities for high milk yield or draught quality should be given greater attention. These Key Village blocks should be developed into nucleus cattle breeding centres as originally envisaged under all India Key Village Scheme and should continue as compact units covering about 10,000 breedable animals to enable complete breeding control including large coverage under milk marketing and herd registration programmes. These centres can be best utilised for progeny testing of bulls at field level. This

will naturally demand continued provision of all infrastructural facilities and financial support over a long time. We, therefore, recommend that the working of the Key Village Scheme should again be quickly reappraised by a team of experts on the lines indicated above.

Intensive Cattle Development Project

28.4.14 Experience with the Key Village project showed that by and large these had failed to produce the desired impact and that the large number of dairy plants set up during the Second and Third Plans were not able to collect sufficient quantities of milk. These considerations led to the formulation of the ICDP as a part of the Special Development Programmes started during the later half of Third Plan. It was envisaged that these projects would be located in breeding tracts of indigenous breeds of cattle and buffaloes and in the milksheds of large dairy projects with a view to enabling the dairy plants to collect and process milk upto their installed capacities. It was emphasised that all the ICDPs should be linked up either with the fluid milk marketing schemes or milk products manufacturing projects. This was considered necessary as cattle improvement for milk production and marketing of milk had to function as complementary to each other.

28.4.15 It was envisaged that each project would cover one lakh breedable cow and she-buffalo population with a view to making a significant impact and increase in milk production in the area. These projects were to be located in areas where good potential and conditions existed to ensure satisfactory response to cattle development and milk production enhancement efforts. The scheme envisaged provision of all necessary inputs and services simultaneously as otherwise the programme might suffer for want of one input or the other. The programme was expected to achieve a breeding coverage of about 70 per cent of the cattle population of each project and an increase in milk production by about 30 per cent over a period of 5 years.

28.4.16 At the end of the Fourth Plan there were 62 ICDPs and under the Fifth Plan it is envisaged that the existing projects would ensure that all the requisite inputs were made available and 51 new projects would be started. Because of the emphasis given under this project to increase milk production through improvement in the quality and productivity of cattle and buffaloes, the Government of India and the State Governments gave a fairly high priority for this scheme during the earlier years. The Government of India extended 100 per cent central assistance for the projects during the Third Plan. After two years, these projects were transferred to the State sector and since then these projects are being continued as State Plan scheme. This

change meant lesser direct financial assistance from the Government of India. In most of the States, this project did not receive sufficient allocation of funds because of which adequate provision of inputs and services could not be made.

28.4.17 The Indian Institute of Management, Ahmedabad made a study on the working of ICDPs in 1967 by which time these projects had been in operation for a period of about 3 years. These studies were not undertaken for evaluation purposes but only as an attempt to examine the tasks in planning and implementation of the programmes for modernising the process of cattle and dairy development in the country. This study acknowledged that the ICDP was one of the most determined efforts on the part of Government of India to increase milk production and productivity in cows and she-buffaloes and that the ICDP concept represented an effective method whereby a powerful tool for cattle and dairy development could be put into the field with great speed. These projects had three advantages viz., (a) an effective pool of animal husbandry personnel; (b) organisational resources to make this field force effective rapidly over a wide area; and (c) the ability of this field force to focus for the milk producers' active desire to make productive changes in their technology. In this report it was emphasised that if the ICDPs were implemented successfully with regard to all aspects of the programme, each Project would in fact become a part of self-supporting system of milk production, procurement, processing and distribution at which point the project would not require any financial support from the States. On the contrary, it would be earning more than what had been put into it.

28.4.18 The Programme Evaluation Organisation of the Planning Commission undertook an evaluation study of the ICDPs in 1970-71. According to this study there was a considerable time lag in providing organisational structure, contents of the programme and various inputs upto the level as detailed in the model plan. The programme received a setback even in its earlier stages of implementation when these projects were transferred to the State sector with consequential financial cuts in central assistance. This resulted in dilution of inputs in the later years when there was greater need to provide the full complement of expert staff, physical facilities for breeding and financial support for extension activities for promoting activities like fodder production and milk marketing. The study revealed that 30-40 per cent of the semen produced was not utilised in most of the projects. The need for giving adequate inservice training to stockmen and providing the necessary equipment and ancillary facilities for increasing the coverage through AI as envisaged under the project was recommended. One significant recommendation made was that fodder development programmes should be integrated with the general agricultural programme

and in that respect the State Agriculture Departments should be intimately involved in devising and recommending an approach for crop rotation and cropping patterns. It was pointed out that the progress made under organisation of rural milk cooperative societies was poor. Further, it was recommended that the programme like ICDP needed periodical review for the assessment of the progress and to take suitable corrective action wherever necessary.

28.4.19 The programme and the progress made under the ICDPs were discussed at the Symposium held on Statistical Assessment of ICDP by the Indian Society of Agricultural Statistics in December, 1972. They recommended that proper sample surveys for assessment and evaluation should be evolved and carried out. Apart from studying the various indicators of progress of the scheme, it was recommended at the Symposium that ancillary studies should cover the cost of production of milk, cost of cultivation of fodder crops, operational research studies on breeding methods and determination of efficiency of AI technique. Some sampling procedures were suggested for organising assessment and evaluation surveys of the ICDPs in a continuous and systematic manner. We recommend that early action should be taken to implement the suggestions made in the above mentioned three studies and particular emphasis should be laid on the involvement of State Agriculture Departments in fodder development programme, organisation of rural milk cooperative societies, periodical surveys and reviews for assessment and evaluation work.

5 CATTLE BREEDING POLICIES

28.5.1 According to the Royal Commission on Agriculture role of cattle in India was mainly as the supplier of bullock power for cultivation. In their opinion, the type of cow most suitable for the average cultivator would be the one capable of producing a strong calf and yielding in addition 1,000 to 1,500 lb* of milk per lactation for household use. Further, the Commission was of the view that under the conditions commonly found in villages, it was unlikely that selling of dairy produce would be more remunerative to cultivators than raising of crops. The RCA concluded that in the breeding of draught cattle milking qualities should be acquired only insofar as these were consistent with the maintenance of essential qualities which good draught cattle must possess. While discussing the production of milk for cities, it was pointed out by them that owners of dairy cattle should

* 1 lb. = 0.453 kg.

aim at producing high yielding cows with a production level of 8,000 lb of milk per annum and not at the level of the dual purpose animal giving 2,000 to 3,000 lb of milk. The RCA anticipated that commercial dairy farms for supplying milk to the cities were likely to resort to crossbreeding in the future. However, in its opinion, the government agricultural departments should not take up experiments on crossbreeding and that departmental endeavours should centre round the improvement in milking qualities of indigenous breeds like Sahiwal and Sindhi or specially selected strains of breeds like Haryana.

28.5.2 Colonel Olver, Animal Husbandry Expert¹, Imperial Council of Agricultural Research* was of the view that it was unsound to introduce European breeds of cattle in India and that it would be a sounder policy to effect systematic improvement in the indigenous stock by means of selective breeding, better feeding and improved management. He concluded that profit from the sale of bullocks was small as compared to the income derived from the sale of milk and other dairy products. Olver suggested that in order to derive full benefit from agriculture, it would be necessary to give greater attention to increase in milk production in cows under a system of mixed farming.

28.5.3 While emphasising the importance of improving milk yield in Indian cattle, Wright² pointed out that in deciding the breeding policy it was necessary to take into account the diverse needs of the different branches of dairy industry. According to him only high yielding milch cows could prove economical for city milk supply while in rural areas draught breeds were needed to produce good working bullocks. He was of the opinion that even in draught breeds it was desirable to obtain as much milk as possible without causing any deterioration in the draught quality. He strongly opposed adoption of large scale crossbreeding to improve the milk yield of local cattle under the prevailing conditions of animal husbandry and recommended that immediate steps should be taken in selecting and improving milk strains of indigenous cattle. He, however, added that such efforts should not be limited only to those breeds recognised as milk types, as improvements in milking capacity could also be looked for in most of the other breeds. He recognised that even draught breeds like Amritmahal and Hissar possessed strains of special milking potentialities. Another important point referred to by Wright was that the breeding policy must take into account the environment under which animals had to live and produce. Referring to the attempts that were generally made to improve the size and productive quality of small countrybred stock by supplying large sized and high production potential sires, he warned that such

¹ Olver, A. 1938. The systematic improvement of livestock in India—*Agriculture & Livestock in India* Vol. No. 9.

* Now designated as Indian Council of Agricultural Research.

attempts might do more harm than good unless they were accompanied by measures to improve the environment of the stock including their feeding.

28.5.4 The Animal Husbandry Wing of the Board of Agriculture and Animal Husbandry of India at its Fourth (1940) and Sixth (1945) Meetings discussed the question of mass improvement of inferior indigenous cattle and recommended that grading up of cattle should be taken up in a systematic way in selected areas. In these areas compulsory castration, proper feeding of the graded progeny and continuous supply of purebred bulls should be ensured.

28.5.5 In 1944 the Government of India invited Pepperall for making a rapid survey of the problems facing the dairy industry in the country. While recognising that the Indian buffalo was a producer of high quality milk and had good economic value, Pepperall¹ emphasised that while buffalo would always retain an important place as a dairy animal, it should be considered only complementary and not as a substitute for the cow upon which rests the dual responsibility of supplying a reasonable quantity of milk and draught power. He believed that under the existing conditions of farming it was not possible for the farmers to maintain separate types of animals for milk and for draught. According to Pepperall there was urgent necessity for increasing milk production but he warned against embarking on a policy of crossbreeding with European bulls. He emphasised that milk yield of indigenous breeds of cattle should be improved rather than attempting large scale crossbreeding with imported bulls.

28.5.6 In 1949 the Goseva Sangh, Wardha advised the Government of India that the ultimate aim in the development of cattle should be the production of dual purpose animals and that the buffalo might also be treated as a dual purpose animal in those areas where male buffaloes were used for cultivation purposes. The ICAR considered the above suggestion of the Goseva Sangh and recommended adoption of the following course for the improvement of cattle in the country :

“(i) In view of the fact that a large percentage of our cattle population comprises non-descript animals, it is essential in the interest of producing a general utility animal that it should combine in itself, draught and milk qualities to the optimum extent; in other words, if in non-descript cattle, these two qualities are combined to an average degree to start with, the purpose will be served.

(ii) In areas where specific types (as distinct from well-defined breeds) exist the policy should be to effect improvement by selective breeding with a view to improving both milk

¹ Pepperall, R.A. 1945. The Dairy Industry of India : Report on an investigation with recommendations.

and work qualities.

- (iii) In the case of well-defined breeds, the objective should be to put in as much milk in them as possible without materially impairing the work quality.
- (iv) In the case of well-defined milch breeds, the number of animals of which has considerably decreased after partition, the Committee is of the considered view that it will be in the larger interests of the country as a whole to develop their milking capacity to the maximum, by selective breeding and to utilise them principally for the development of cattle in under-developed areas."

28.5.7 The Twelfth and Thirteenth meetings of the Animal Husbandry Wing of the Board of Agriculture and Animal Husbandry recommended that breeding programmes for the cows must place maximum emphasis on milk production and that the breeding of milch animals should be encouraged in rural areas adjoining towns. Regarding buffaloes it recommended that every effort should be made to improve their milking qualities by judicious breeding, and popularising improved practices of feeding and management.

28.5.8 An Expert Committee was set up by the Government of India in 1959 to review and evaluate the work done under the All India Key Village Scheme. The Committee recommended that while draught quality in cattle was important, every effort should be made to increase milk production as quickly as possible. For achieving this objective, the Committee suggested that improvement of buffaloes should be undertaken wherever they have been found suitable and in the case of non-descript cattle even crossbreeding with exotic breeds might be resorted to where climatic and other conditions were favourable. In the case of well-defined breeds or specific types it was considered essential that their milking quality should be improved through selective breeding. The Committee was of the view that in areas where specialised breeds already existed, no cross-breeding should be permitted.

28.5.9 The future approach to the problem of cattle development was discussed by the Gosamvardhana Council in 1960, and particular attention was drawn to the fact that due to years of neglect the cow in India had lost its due place in the integrated agricultural pattern in the country. The Council pointed out that there was an urgent need for giving immediate attention to the improvement of the cow under developmental programmes.

28.5.10 There has thus been a gradual shift in the approach to cattle development policy subsequent to the Report of the RCA. It was emphasised in the Third Plan that the breeding policy should generally be to develop dual purpose breeds of cattle for milk and

draught and that the dairy programmes should be effectively interwoven with the economy of the surrounding villages. In the case of large city milk supply schemes, it was stressed that every effort should be made to link the dairy plants with the countryside to help enriching the rural economy through development of cattle with the twin objectives of increasing milk production and supplying good animals for draught purposes. For the hill areas a policy of crossbreeding with Jersey breed was advocated.

28.5.11 The Animal Husbandry Wing at its Fourteenth meeting (1961) considered the need for effecting a rapid increase in milk production in cattle and suggested certain changes in the existing cattle breeding policy so as to permit crossbreeding of nondescript cattle with exotic breeds. It was recommended that the existing breeds might be reclassified and animals of those breeds considered unimportant in the context of the present day needs might be graded up with other improved indigenous breeds. In order to supplement the work of the government cattle breeding farms in the production of superior bulls, it was proposed that private cattle breeders should be encouraged to undertake breeding work on scientific lines and be given financial assistance for this purpose. It was further recommended that crossbreeding should be taken up in areas having nondescript cattle, if these areas were otherwise suitable for maintenance of crossbred animals and were connected to large milk consuming centres. It was suggested that a limited number of exotic breeds should be selected on the basis of experience gained from work already done in India and in other tropical countries and that not more than one exotic breed should be introduced in any one area.

28.5.12 The cattle breeding policy in general and the policy to be adopted concerning crossbreeding with exotic breeds were examined in 1961 by a Committee set up by the Central Council of Gosamvardhana. The Committee recommended that crossbreeding programmes should be taken up in an intensive manner using two or more exotic breeds in three selected areas one each in the plateau, the plains and the hills. It was also suggested by the Committee that while taking up crossbreeding on a large scale, in new areas the places should be carefully selected so that crossbreeding might not conflict with the needs and preferences of the local farmers. It was further proposed that in the plains crossbreeding should be started in areas where the holdings were small, agriculture was intensive, cattle were stall-fed and where farmers are interested in breeding cows for milk production.

the Union Ministry of Agriculture & Irrigation reviewed the cattle breeding policy in 1965 and suggested that selection among the indigenous purebreds, grading up of nondescript cattle with established indigenous breeds and crossbreeding with exotic dairy breeds should be undertaken in an intensive and coordinated manner, ensuring simultaneously provision of suitable environmental conditions. The Panel emphasised that bulk of the exotic inheritance should be obtained through Jersey breed and that crossbreeding with Brown Swiss and Holstein Friesian might also be tried to a limited extent. It was suggested that for sometime to come crossbreeding programme should be limited to obtaining halfbreds and to follow *inter se* breeding among these halfbreds. However, in areas where feed and fodder availability was satisfactory and farmers were progressive there could be scope for producing crossbreds with higher level of exotic inheritance.

28.5.14 The Fourth Five Year Plan laid great emphasis on crossbreeding of cattle for milk production. It was rightly stressed that the success of crossbreeding programme would depend on the quality of crossbred bulls used for *inter se* breeding and that crossbreeding should be implemented in a planned and controlled manner. We have also emphasised in our Interim Report on Milk Production that the first pre-requisite for the success of any such dairy development programme will be the supply of animals which are economic producers. We have further recommended that clear-cut objectives should be laid down while taking up crossbreeding schemes in the rural areas particularly in regard to the level at which the exotic inheritance has to be stabilised in order to ensure the best possible combination of the high milk yielding potential of the exotic breeds and the stamina and the hardiness of the indigenous cows. We have pointed out that the draught capacity of bullocks particularly with the small farmers will not be adversely affected through the adoption of crossbreeding of indigenous cattle with exotic breeds as the crossbred bullocks would be stronger than the ordinary bullocks owned by majority of the small farmers.

28.5.15 In recent years it has been rightly realized that unless crossbreeding of indigenous cattle with exotic dairy breeds is undertaken in a big way, it will be well-nigh impossible to bridge or even narrow the gap between the availability of and demand for milk in the country. In our opinion the emphasis on future cattle as also buffalo development should be on (a) increasing milk production with a view to improving the dietary of the people in general and to meet the ever increasing demand for milk and milk products of the urban population and the growing industrial complexes; and (b) on improving the

working efficiency of bullocks in the rural areas. Breeding for milk production should be concentrated in milkshed areas that could be conveniently linked up with the existing dairy projects and those to be taken up in the near future. Production of milk should be on a commercial basis and it should be sufficiently remunerative to attract the farmers to milk production enterprise. This should be attempted through a system of planned crossbreeding; selective breeding and grading up of indigenous cattle; and selective breeding and grading up of buffaloes depending upon the suitability of each system under the prevailing local conditions. We have dealt with these aspects of cattle and buffalo breeding in Sections 6, 7, 11 and 12.

6 CATTLE BREEDING FARMS

28.6.1 Production of breeding bulls is not undertaken in a large way by private breeders because it is not remunerative to them. It was, therefore, found necessary for the Government to set up cattle breeding farms to develop improved herds of various breeds. With the introduction of All India Key Village Scheme for cattle development in the First Plan, the requirements of superior pedigree bulls of various breeds of regional and national importance increased considerably and the inadequacy of the existing farms to meet the demand was realised. The establishment of new farms and strengthening of the existing ones were, therefore, taken up.

28.6.2 We have collected information from the State Directorates of Animal Husbandry regarding the position, objectives and progress made in the cattle breeding farms run by the State Governments. We find that by and large these farms have been able to raise purebred herds for supply of bulls and to serve as demonstration centres on cattle management and fodder production. However, the efficiency of working and the contribution made by these farms should be judged from the extent of genetic improvement achieved in the herds from generation to generation. The IARS¹ had carried out critical examination of the data on some of the leading herds at livestock farms of the Central and State Governments as well as some private institutions. The bulk of the data examined pertained to the period 1930 to 1956 and consisted of records of nearly 2,000 cows and 230 bulls. The results of these studies showed that there was ample scope for improvement in these herds through genetic

¹ Ambie, V.N., Krishnan, K.S. and Soni, P.N. 1967. Analysis of breeding data of some important Indian herds of cattle. ICAR Tech. Bull. (AH). No. 6.

selection which had not been exploited for lack of adoption of scientific breeding programmes. Bulls had been selected mostly on the basis of their appearance, outwards characters and milk yield of their dams. Hardly any attempts had been made for evaluating their breeding worth on the basis of the performance of their progeny. It was concluded from this study that (a) there had been fluctuations in the performance from generation to generation, (b) in some herds even deterioration had occurred, (c) wherever the herds at Government Farms exhibited superiority over the stock in the field it was due to better feeding and management and (d) there was little or no genetic improvement effected in the stock. The urgency of adopting scientific breeding programmes based on progeny testing of bulls to bring about systematic and progressive improvement in the production potential of the stock thus became apparent. The IARS had estimated that for the satisfactory evaluation of a sire it had to be mated to at least 30 cows and that on an average only one out of 10 sires would have an index of 20 per cent above the herd average. It was, therefore, recommended by the IARS that a stock of 300 breeding cows in one or more herds would be required for a successful progeny testing programme in order to have reasonable chance of discovering one or two outstanding bulls from a set of 8 to 10 bulls tested at a time.

28.6.3 In the light of the above requirements we examined the size of herds of some important indigenous breeds of cattle at the Government farms. Relevant information is given in Table 28.3.

TABLE 28.3

Breedwise Frequency Distribution of Herds According to Herd Size of Cows and She-buffaloes

Breed	Number of Adult Cows and She-buffaloes				Total Herds
	Below 30	30-60	61-150	Above 150	
Hariana	2	6	5	8	21
Tharparkar	3	3	4	2	12
Sindhi	8	2	5	1	16
Gir	2	1	5	2	10
Ongole	4	1	..	1	6
Kankrej	1	1	2	..	4
Murrah	9	22	10	4	45
total	29	36	31	18	114

It would be seen from Table 28.3 that one major constraint in taking up progeny testing programme is the small size of herds. As nearly 60 per cent of the farms have herds of less than 60 animals each it would be difficult to adopt a coordinated breeding programme even

by linking up two or more farms located in the same agroclimatic area. We, therefore, recommend that either increase in the size of these herds should be attempted or only one breed of cattle and/or buffaloes should be maintained on each farm.

28.6.4 Most of the cattle breeding farms need reorganisation and strengthening so that a planned breeding programme could be undertaken for effecting progressive genetic improvement. We recommend that each State Government should set up a team of animal breeding and farm management specialists to study the working of the existing cattle/buffalo breeding farms and to make comprehensive suggestions for their working on scientific and economical basis. Such of the small forms which do not offer scope for maintaining a herd of sufficient size to take up a breeding programme either alone or in conjunction with other farms should be closed down or utilised for maintaining other livestock.

28.6.5 The Union Ministry of Agriculture and Irrigation while formulating cattle development programmes for the Fourth Plan, viewed with concern the lack of necessary resources with most of the existing livestock farms for attaining progressive genetic improvement methods. As a result these farms were functioning at best as multiplication farms for purebred stock. Even though certain measures for improvement of the farms had been taken up under the scheme of expansion/organisation of livestock farms under the Second and Third Plans, they could not put the breeding work on scientific lines. The Ministry, therefore, decided to set up 6 large cattle breeding farms on its own and to select a few suitable cattle breeding farms in the States to implement a coordinated breeding project for genetic improvement in these herds through scientific breeding based mainly on progeny testing of bulls. Accordingly, the establishment of four cattle breeding farms one each for Sindhi, Tharparkar, Jersey and Holstein breeds and two buffalo breeding farms one each for Murrah and Surti was taken up.

28.6.6 It was envisaged that each of these farms would develop a herd of atleast 300 cows/mature heifers so that 10 bulls at a time could be progeny tested. Each farm was expected to have about 750 animals when fully established. The requirements of land for fodder cultivation at an intensity of cultivation of 125 per cent were estimated around 750 acres. The establishment of five of these farms was sanctioned during the Fourth Plan period as detailed below :

Name of Farm and Location	Area in acres	Breed	Year of starting
Central Cattle Breeding Farm, Suratgarh .	1,128	Tharparkar	1967
Central Cattle Breeding Farm, Chiplima .	1,400	Sindhi	1968
Central Cattle Breeding Farm, Dhamrod .	1,362	Surti	1968
Central Cattle Breeding Farm, Koraput .	1,014	Jersey	1972
Central Cattle Breeding Farm, Alamadhi .	1,133	Murrah	1973

The progress made so far under these farms has been below the original expectations as none of the farms could develop the requisite herd size to start progeny testing programmes. The slow pace of progress may be attributed to difficulties in locating and acquiring suitable land of adequate size with irrigation facilities, delay in construction of buildings recruitment of staff, nonavailability of animals satisfying specifications etc. We view with concern such a long delay in stocking these farms with sufficient number of cows and bulls. We suggest that setting up of large farms in new locations should be avoided in future unless it is assured that all facilities and finances would become available to set up the farms within a reasonable period of time.

28.6.7 The Union Ministry of Agriculture and Irrigation sponsored a scheme in the Fourth Plan for assisting the State Governments to build up facilities at selected suitable farms for undertaking planned progeny testing programmes. Nine such farms are at present getting financial assistance and the details of these are as under :

Location	Breed	(Rs. in lakhs)	
		Year of Starting	Total central assistance
1	2	3	4
Chakganjaria (Uttar Pradesh)	Sahiwal	1971	4.25
Durg (Madhya Pradesh)	Murrah	1971	17.06
Bharatpur (Rajasthan)	Haryana	1972	13.00
Gaurikarma (Bihar)	Jersey	1972	12.33
Hosur (Tamil Nadu)	Red Sindhi	1972	13.37
Banavasi (Andhra Pradesh)	Murrah	1972	14.00
Junagarh (Gujarat)	Gir	1972	10.08
Barpeta (Assam)	Jersey	1972	6.95
Hosonghatta (Karnataka)	Red Dane	1973	10.55

We recommend that the Central Government should identify more farms and extend financial assistance to them for such a programme. The State Governments should be discouraged from spending funds on smaller farms or on establishment of farms with small herds. Farms for draught breeds should be set up where the breeds are of excellent quality as in the area of Nagore breed.

Exotic Cattle Breeding Farms

28.6.8 The State and Central Governments have established herds of purebred Holstein-Friesian, Jersey and Red Dane. The stock was imported either through foreign assistance programmes or direct purchase. As the number of animals imported was limited most of these farms have very small herds. Out of 39 herds only 13 have 60 cows

or more where some planned crossbreeding programmes could be adopted (Appendix 28.4). The other herds are smaller and as such may merely help in making available a few bulls. We recommend that wherever possible the small herds may be combined to form a large herd at the most convenient farm. When more imports are made, new herds of small sizes should not be set up, rather the States should build up the existing herds to adequate size. In our opinion, there should be at least 150 cows/mature heifers at each of these farms to enable them to take up a proper breeding programme.

7 MILITARY DAIRY FARMS

28.7.1 The Military Farms Corps of the Union Ministry of Defence maintains large herds of cattle and buffaloes for milk production. These farms function on the lines of quasi-commercial departments. The origin and history of the military farms is interesting. In the latter half of the nineteenth century a large number of British troops and their families were inducted in India. The responsibility of providing rations to these people was vested with the Master General of Supplies. Milk and milk products were important articles of diet for them and these were being arranged from local sources. The incidence of diseases among the British troops and their families was found to be high and this was attributed to poor quality milk supplied to them. This situation forced the military establishment to start a dairy of its own in 1889 at Allahabad. The successful functioning of this farm led to the establishment of more farms in many other cantonments. On 1st April, 1975 there were 24 military farms with a total of 9,835 animals comprising 7,231 cows and 2,604 buffaloes.

28.7.2 Breeding policy : Military farms were the first to take up organised crossbreeding of indigenous cattle with European breeds on a large scale. This was found necessary because of poor milk yield of indigenous cattle as well as their late maturity and long calving intervals. The first importation of Ayr shire stock was made in 1907. The RCA referred to the useful crossbreeding work being done at the military dairy farms in testing the merits of different imported breeds. It was of the view that the military farms had effected great improvement in the milk yield of their herds chiefly through crossbreeding and selection although feeding and management of cattle had also contributed to this.

28.7.3 The crossbreeding work with European breeds was continued till 1952 when a Committee of Experts recommended that in view of dependence on foreign countries for exotic bulls the crossbreeding

work should be discontinued and that the crossbred stock at the military farms should be back-crossed with bulls of indigenous breeds. It was also recommended that herds of Indian zebu breeds of cattle should be introduced in these farms and improved by selective breeding. Crossbreeding was, therefore, discontinued and indigenous breeds of cows like Sahiwal, Sindhi, Haryana, Gir and Tharparkar were introduced. The ban on crossbreeding in military farms was removed in 1958 on the recommendation of the Reorganisation Committee¹ which was of the view that the crossbred herds should be enlarged and that crossbreeding work should be undertaken with Friesian bulls. Maintenance of exotic inheritance at 50 per cent level in crossbreds was suggested by this Committee.

28.7.4 The Military Farms Directorate imported 15 Friesian bulls from Holland in 1960 and restarted crossbreeding work. Additional bulls of exotic dairy breeds were supplied by the Union Ministry of Agriculture from stock obtained from Ceylon (Sri Lanka), Australia and New Zealand. During 1972-73, 12 more bulls were obtained from USA. The total number and composition of crossbred cows in the military farms as on 1st April 1969 and 1st April 1973 are given below :

Level of exotic inheritance	1st April 1969	1st April 1973
7/8 and above	36	111
3/4	340	465
5/8	434	992
1/2	334	757
	<hr/>	<hr/>
	1,144	2,355
3/8	44	160
1/4	997	849
1/8 and below	948	817
	<hr/>	<hr/>
	3,133	4,151

It can be seen from above that in about 4 years time the military farms have made a substantial increase in the size of the crossbred herd and are having a large proportion of animals with higher level of exotic inheritance. The following cattle breeding policy has recently been introduced in the military dairy farms :

- “(i) Purebreeding of Sahiwal and Sindhi cows yielding or expected to yield 2,000 kg or more of milk in a single lactation of 300 days.
- (ii) Crossbreeding of Sahiwal and Sindhi cows which yield or are expected to yield less than 2,000 kg of milk in a single lactation of 300 days and that of Tharparkar, Gir and

¹ Personal communication: Director of Military Dairy Farms, New Delhi.

- Hariana cows with Friesian breed to get crossbreds.
- (iii) Forward crossing of crossbred cows with 62.5 per cent or less exotic inheritance with Friesian breed.
 - (iv) Backcrossing of crossbred cows with over 62.5 per cent exotic inheritance with Sahiwal breed.
 - (v) Development of the small herd of purebred Friesian cows at Meerut through use of superior Friesian bulls."

28.7.5 As far as crossbreeding is concerned, a crisscross system of breeding is thus being followed at the military farms. Such a system of breeding is adopted in foreign countries in commercial herds of livestock maintained chiefly for production and not for producing animals for breeding purposes. As the present stock of crossbreds in the military dairy farms which has to be used as foundation stock for breeding comprises a large number of animals with different levels of exotic inheritance, the resultant progenies in the coming years would be of a wider assortment of crossbred animals. In this system of breeding, apart from production level going up and down it would also be a difficult task to keep track of the parentage of each animal and determine the proportion of the exotic inheritance in each one of them. Even though milk production is expected to be maintained at a satisfactorily high level in the herds through this system, these will not be of any use for production and supply of genetically superior breeding animals for development of cattle in the rest of the country. Animals of these herds will also not be of much use in the organised breeding programmes.

28.7.6 We recommend that the Military Farms Directorate should examine their present crossbreeding policy in consultation with the leading animal breeding specialists in the country and lay down a definite long-range crossbreeding programme. This will enable them to develop genetically uniform and stable crossbred populations. This will also supplement the efforts being made under large scale crossbreeding programmes in the rest of the country for increasing milk production. It is not our intention to suggest that the crossbred cattle at all the military farms should have the same level of exotic inheritance. The military farms are located in different agroclimatic conditions, and have varying feeds and fodder resources. On the basis of these considerations, the military farms can be categorised into groups that can maintain stocks of different levels of exotic inheritance at a satisfactory level of production and general health. In military farms where stock could be raised with better feeding and management regimes the crossbred stock could be of higher grades, say having 75 per cent exotic inheritance. The farms having such facilities at medium levels might maintain stock at 62.5 per cent level and the remaining farms at 50 per cent of exotic inheritance. The present stock of crossbred animals could be grouped

accordingly and shifted to the farms which are to multiply crossbreds of that type. In this manner the value of stock would get considerably enhanced as herds of stabilised crossbred population would get developed. After achieving this objective in a satisfactory manner, the military farms should take up studies on comparative performance of the different types of crossbreds and their adaptability in different agroclimatic regions by transferring and maintaining small herds of adequate size.

28.7.7 The above suggestion does not envisage any intricate research investigation but only systematic collection of data on production, reproduction, performance, growth rate, mortality etc. Such studies will furnish useful information which can help in laying down a suitable crossbreeding policy for general use in different regions of the country. The RCA was of the view that experimental work should not altogether be ruled out of the programmes of military farms which, due to large sizes of their herds, had good opportunity for advancing Indian experience in cattle breeding. In our opinion the suggestion of the RCA continues to remain valid and has added significance as military farms have done considerable crossbreeding work in recent years and their experience can add useful information to the crossbreeding programmes being undertaken on a countrywide scale. The RCA had recommended that any additional expenditure which these experiments might involve should form a proper charge on the funds allocated for promotion of research. We endorse this recommendation as the military farms department may find it difficult to incur any extra expenditure on experimental work because these farms are primarily intended for economic milk production and are to run on commercial lines. The Union Ministry of Agriculture and Irrigation and ICAR should, therefore, actively collaborate with the working of the crossbreeding programmes in the military dairy farms and should extend both expert advice and financial support for these experiments.

Progress and Achievements

28.7.8 Military farms have achieved a good measure of success in their attempts to improve the productivity and the reproductive efficiency of both cows and buffaloes in their herds through better feeding and management practices. At these farms, it has become possible to inseminate heifers at an average age 15 months or when they attain a bodyweight of 260 kg through giving special attention to feeding of youngstock. The age of maturity in crossbreds has been reduced by 6 to 7 months and the average age of calving is at present around 2 years and 4 months. The military dairy farms adopt a strict culling policy

under which she-buffaloes yielding less than 1,800 kg of milk, crossbred cows with less than 50 per cent exotic inheritance giving less than 1,600 kg milk and crossbred cows with 50 per cent or more of exotic inheritance having lactational yields less than 2,500 kg of milk are culled out from the herds. These measures have helped military farms to improve the breeding efficiency and to economise on the cost of milk production.

28.7.9 The experience and good results obtained in the adoption of improved dairy management practices in the military dairy farms should be made use of in production of purebred exotic bulls. The Military Farms Directorate should earmark one of its farms like the one at Meerut which has got adequate facilities for housing and fodder production, for developing a purebred exotic cattle breeding farm. The Union Ministry of Agriculture and Irrigation should provide a large foundation herd of about 300 Holstein-Friesian cows. Such a step would overcome the long time lag that is experienced in starting a new farm with adequate facilities such as land, building, irrigation etc.

28.7.10 The military farms are at present producing nearly 5,000 crossbred calves and 1,500 buffalo calves every year. We are informed that the military farms need only 1,500 crossbred and 200 buffalo heifer calves for replacement of stock and strengthening the herds. The remaining calves become surplus to their requirements every year. As the military farms are not in a position to rear them up to maturity/production because of non-availability of required facilities and economic considerations, the farm authorities usually offer surplus calves up to the age of 15 days free of cost to any individual or organisation. In view of the difficulties in rearing such young calves no demands are forthcoming for such calves. A few years ago the Union Ministry of Agriculture formulated a project under which the Military Farms Directorate agreed to rear calves up to 1 or 2 years of age provided firm demands were made by the State Departments of Animal Husbandry or other institutions like gaushalas. However, this scheme did not make any headway. The demand for high yielding cows is on the increase and a large number of dairy projects have come into operation. Superior calves/cows are also needed for distribution to small and marginal farmers and agricultural labourers. In our opinion, the military farms could be one good source for making available superior heifers for distribution in the milksheds of dairy plants and in areas covered by Small and Marginal Farmers Development Agencies (SMFDA). The military farms have recently started on their own six youngstock farms where a limited number of superior cow calves and buffalo calves are reared up to maturity. Most of these may be required for the replace-

ment of their herds. As the costs are high the demand from public for purchase of these calves has been negligible. A large number of calves from the military farms thus go waste. It is necessary to find a way out as to how best this annual loss of potentially high yielders of milk could be avoided. One suggestion could be that the military farms should take up rearing of large number of superior heifer calves at their youngstock farms. It has been estimated by the Military Farms Directorate that the cost of rearing a calf up to 12 months of age under the existing conditions of management would amount to about Rs. 1,500. This will make calf rearing very uneconomical. We suggest that the State Governments should convert some of their existing farms located in areas of surplus grass production into youngstock rearing farms, so that growing heifer calves could be maintained economically on grass and hay alone.

8 GAUSHALAS

28.8.1 Gaushalas are in existence for the last two centuries. These are being maintained on account of religio-economic considerations. These institutions are mostly concentrated in the northern parts of the country and till recently had ample financial resources. Considering the resources available and the scope offered by them in supplementing governmental efforts for improvement of cattle for milk production the Animal Husbandry Wing of the Board of Agriculture and Animal Husbandry suggested the need for their reorganisation and development. In pursuance of the recommendations of the Animal Husbandry Wing a meeting of the representatives of a few important gaushalas was held in 1944 under the auspices of the ICAR. The general view at this meeting was that these institutions could be organised on a coordinated basis to enable them to function as effective agencies for cattle development.

28.8.2 The reorganisation and development of gaushalas as centres for cattle breeding and milk production started with the setting up of a Central Gaushalas Development Board by the Government of India in 1949. Later, the Central Council of Gosamvardhana (CCG) was established in 1952 by the Government of India to act as the central coordinating and advisory body on cattle development. The CCG undertook a detailed countrywide survey¹ with a view to assessing the resources of the gaushalas and to evolve a suitable scheme for their development.

¹ Makhijani H.J., 1956. *Gaushalas and Pinjrapoles in India*. Central Council of Gosamvardhana, New Delhi.

The survey showed that there were 1,020 organised gaushalas in 21 States which maintained about 130,000 cattle, produced about 300,000 maunds of milk and about 1,400 breeding bulls. It was estimated by the CCG that about 11,000 persons were regularly employed by these institutions and that on an average, a gaushala possessed 151 acres of grazing area and about 63 acres of cultivable land. This worked out to an average of about 1 acre of grazing area and 0.5 acre of cultivable area per head of cattle.

28.8.3 The CCG sponsored an ad hoc scheme for the development of gaushalas and extended financial assistance for establishment of federations of gaushalas and Pinjrapoles in the States and their smooth functioning. Some of the States appointed Gaushala Development Officers for extending technical assistance and guidance to the gaushala managements. A comprehensive Gaushala Development Scheme was included under the Second Plan for the development of 346 gaushalas. In all 242 gaushalas were assisted for development during the Plan period. The scheme was continued under the Third Plan for developing 168 more gaushalas. From the Fourth Plan the scheme was transferred to the State sector and this programme received very low priority in the allocation of funds.

28.8.4 The CCG after reviewing the progress of the Gaushala Development Scheme decided that it would be desirable to concentrate attention on harnessing the facilities and activities of selected progressive gaushalas¹ for developing pedigree herds of cattle and for initiating cattle development and milk production activities, in the rural areas around them. The Council accordingly drew up a programme to study 100 well managed gaushalas with special reference to their working plans with a view to extending their activities and the scope which they offered for further development. Such a study was made by the Council in respect of 10 gaushalas in Bihar, Rajasthan, Maharashtra and Uttar Pradesh. Later the Council obtained detailed plans for development of progressive gaushalas and extended loan assistance to 25 gaushalas for the purchase of cows and bulls and for the development of resources for the production of feed and fodder. However, with the closure of the CCG in 1969, the incentive provided by a central non-official organisation to coordinate and improve the functioning of gaushalas was lost.

28.8.5 By and large the programme for development of gaushalas received little attention from the Central and State Governments as the impact made by these institutions on cattle development and milk production was not considered significant. The financial assistance ex-

¹ *Progressive Gaushalas and Pinjrapoles*. Central Council of Gosamvardhana, New Delhi.

tended to gaushalas was inadequate in most cases for meeting their requirements in respect of stock, housing, irrigation etc. Hence the gaushalas did not get sufficient incentive to follow the advice and guidance from the State Departments of Animal Husbandry. In the case of smaller institutions the assistance was inadequate to build up herds of adequate size for taking up any development and extension work.

28.8.6 Instances are, however, there where gaushalas have made remarkable progress in recent years. Gaushalas at Nasik, Urlikanchan, Amritsar, Indore and Ahmednagar are a few among them. These examples show that the resources and facilities available with the gaushalas if suitably harnessed could enable these institutions to play an effective role in cattle development. We are of the opinion that in pursuance of the policy initiated by the CCG, available facilities, with selected gaushalas should be studied for developing sizeable herds of superior purebred cattle or for undertaking a crossbreeding programme for increased milk production. The Government of India should provide financial assistance for creating adequate facilities like land, buildings, stock, irrigation, equipment, machinery etc. for meeting operational costs so as to enable these institutions to undertake breeding programmes for herd improvement on scientific lines. Such a scheme for coordinated development of gaushalas should be formulated on the lines of the coordinated cattle breeding scheme of the Government of India under which State Government farms have been supplemented to undertake progeny testing programmes. In this way some selected gaushalas could be utilised to build up purebred herds of cattle of all India and regional importance and herds of crossbred cattle with a definite level of exotic inheritance. It would be necessary for the Government of India to assist in the formulation of projects in respect of those gaushalas whose management undertakes to abide by the specified conditions for implementing the breeding programme, maintenance of production and other records, proper feeding, animal health care etc. Gaushalas, interested mainly in augmenting milk production, should be given a planned programme of crossbreeding. The Government of India should ensure periodic supervision of working of the scheme and extension of technical advice so that the funds provided are utilised for the specified purposes. The gaushalas which have smaller herds but otherwise have sound and progressive management should be assisted by the State Governments to strengthen their purebred indigenous herds for production of superior bulls and for increased milk production. The superior bulls produced could be taken over by the Government on payment for use in their cattle improvement programmes.

28.8.7 Besides gaushalas, there are a number of other non-official

institutions such as educational societies, trusts, and other private organisations which maintain dairy herds. These organisations can provide efficient management but are in many cases in need of technical advice and financial support for increasing the size of their herds and to run those on scientific and economical lines. These institutions should be included in the development projects recommended for gaushalas. The successful implementation of these programmes would obviate the need for setting up a large number of farms by the Government involving huge outlays.

9 ROLE OF INDIGENOUS BREEDS OF CATTLE

28.9.1 A large majority of the indigenous cattle are nondescript and are low and inefficient producers. However, some well developed indigenous breeds/types of cattle exist in different parts of the country which have been evolved over generations by the professional cattle breeders. The RCA drew particular attention to the remarkable powers of endurance of the Indian cattle and their resistance to tropical animal diseases, especially the tick borne protozoan infections. In view of these qualities of the indigenous cattle, the RCA recommended that cattle breeding endeavours should aim at bringing about improvement in the milking qualities of the indigenous breeds like Sahiwal and Sindhi and selected strains of breeds like Hariana.

28.9.2 While deciding upon the type of cattle to be introduced into an area, it should be ensured that the particular type would be able to adapt to the new environmental factors. Several parts of the country do not offer favourable environment for production of highly specialised dairy animals. In such areas, improvement of cattle should be brought about either by selective breeding among local types/breeds or through grading up using improved breeds from other regions of the country which have similar environmental conditions. Zebu cattle are considered as the most productive types found in the tropics. These have been introduced in a number of countries colonised by the Europeans where cattle from temperate regions could not be introduced successfully.

28.9.3 There are about 26 breeds of cattle and 7 breeds of buffaloes in the country which have been recognised and classified into milch, dual purpose and draught types. However, breed characteristics have so far been laid down by the ICAR in respect of only 12 breeds of cattle and 4 breeds of buffaloes. Investigations¹ carried out in the

¹ Oliver, A. 1938. The systematic improvement of livestock in India. *Agriculture and Livestock in India*. 8(9).

late thirties by the Animal Husbandry Bureau of the then Imperial Council of Agricultural Research had shown that in some areas selected milch breeds of pure Indian origin could be raised to high levels of efficiency by scientific feeding and management combined with systematic breeding and disease control.

28.9.4 The role of cattle as the main source of motive power for agriculture and certain allied operations would continue to be almost as important as meeting the requirements of milk in the country. It has been estimated in Chapter 50 on Farm Power that about 80 million bullocks would be needed. There is a need to improve the working efficiency of the bullocks through improved breeding and feeding practices.

28.9.5 We have suggested in paragraph 28.5.15 that breeding for milk production should be concentrated in milkshed areas that could be conveniently linked up with the existing dairy projects and those to be taken up in the near future. Production of milk should be on a commercial basis and it should be sufficiently remunerative to attract the farmers to milk production enterprise. This should be attempted through a system of planned crossbreeding; selective breeding and grading up of indigenous cattle; and selective breeding and grading up of buffaloes. The areas and cattle population that have so far been covered under the programmes of crossbreeding are very limited. We, however, expect that the programme would get progressively enlarged as marketing of milk covers more areas and the requisite inputs and services are extended to ensure successful breeding and rearing of crossbred cattle. Even then the cattle population that would be left uncovered by the programmes of crossbreeding will be quite large in each State.

28.9.6 Cattle population under crossbreeding programmes at present is about 2 million. This figure has been worked out on the basis that there are nearly 1,000 exotic/crossbred bulls for breeding at the AI centres and that each bull could take care of the breeding of about 2,000 cows per annum. This is of course an optimum anticipated coverage. According to information collected by us, however, the actual number of inseminations per bull in the country as a whole is only around 300 in a year at present. We have recommended intensive steps to be taken to increase the breeding coverage through AI centres. Extensive programmes will have to be taken to expand coverage under AI. Even if about 19 million, i.e., about 40 per cent of the total breedable cows in the milksheds and the potential milk producing areas are brought under the crossbreeding programme by 2000 AD, this would still leave out nearly 32 million cows that would have to be improved in rural areas not covered by crossbreeding or organised milk marketing programmes. About one-third of these may be of improved types

belonging to distinct indigenous breeds. If the benefits of cattle development programmes are to percolate to a larger section of the rural population, simultaneous efforts will have to be made to effect some improvement in the milk production as well as draught capacity among improved indigenous and nondescript cattle with the farmers in these areas. Planned programmes should be undertaken for improving purebred cattle in breeding tracts through selective breeding and nondescript type of cattle in other areas through the Key Village Scheme. In a number of Key Village blocks lying in the milksheds of dairy plants, crossbreeding with exotic dairy breeds has been accepted as the breeding policy to augment milk production. Assuming that crossbreeding is adopted in about one fourth of the Key Village blocks, the scheme would be covering only about 3 million breedable cows for improvement through selective breeding or grading up. This indicates that massive efforts are needed to improve the quality of cattle in regard to both milk production and draught over large areas of the country through the use of some of the distinct indigenous breeds of cattle.

28.9.7 The breeds that show promise for either selective breeding in the breeding tracts or grading up cattle in other areas are Haryana for large tracts of Haryana, Punjab, Uttar Pradesh, Madhya Pradesh, Rajasthan and Bihar; Tharparkar in Rajasthan, Madhya Pradesh and Uttar Pradesh; Sindhi in Kerala, Tamil Nadu, Orissa, Assam and hill areas; Kankrej in Rajasthan and Gujarat; and Gir in parts of Gujarat, Maharashtra, Rajasthan and Madhya Pradesh. These breeds can play a useful role in improving the low producing stock of vast areas of the country.

28.9.8 The IARS had studied data on some important herds maintained at a few selected Central and State Government farms as well as private institutions. These studies¹ pertained to the Red Sindhi and the Kankrej herds of Hosur Cattle Farm, the Red Sindhi and the Gir herds of Southern Regional Station of NDRI, Bangalore, the Tharparkar herd at Government Cattle Farm, Patna and the Kankrej herd at the Agricultural Institute, Anand. The averages in respect of lactation yield, lactation length and yield per day which are based on first lactation records are given in Table 28.4.

TABLE 28.4
Milk Records of Some Important Cattle Herds

Breed	Name & Location of the herd	Lactation yield (lb.)	Lactation length (days)	Yield per day of calving interval (lb.)
Sindhi . . .	Hosur	3,666 (290)	317 (290)	7.07 (261)
Sindhi . . .	Bangalore	2,684 (256)	264 (256)	6.26 (237)

¹ Amble, V.N., Krishnan, K.S., and Soni, P.N. 1967. Analysis of breeding data of some Indian herds of cattle. *Indian Council of Agricultural Research Technical Bulletin (Animal Husbandry)*, No. 6.

Breed	Name & Location of the herd	Lactation yield (lb.)	Lactation length (days)	Yield per day of calving interval (lb.)
Tharparkar (calves not weaned)	Patna	2,863 (229)	311 (229)	6.13 (223)
Tharparkar (calves weaned)	Patna	2,818 (206)	279 (206)	7.16 (192)
Kangayam . . .	Hosur	1,416 (379)	264 (399)	3.19 (317)
Gir . . .	NDRI Bangalore	2,866 (76)	286 (76)	6.33 (69)
Kankrej . . .	Anand	4,070 (76)	351 (76)	9.44 (73)

Note : Figures within parentheses indicate the number of records on which the averages are based. Data in respect of all the generations in each farm since its inception were pooled and analysed for arriving at these averages.

It would be seen from Table 28.4 that by careful selection and under improved management conditions, herds of indigenous cattle with a high level of milk production could be built up. We, therefore, recommend that in parts of the breeding tracts of Rathi, Tharparkar, Kankrej, Hariana and Gir cattle where crossbreeding with exotic breeds is not likely to be introduced, intensive selective breeding either through AI or natural breeding should be undertaken. This will preserve, improve and multiply animals of these breeds. Bulls used for breeding through AI in such programmes should preferably be progeny tested and the bulls for natural breeding should be of superior pedigree. Similarly, in pockets with graded animals the stock should be further improved through the use of high pedigreed bulls. In large areas of nondescript cattle which do not offer scope for marketing of milk and where the inputs and services for successful introduction of crossbreeding with exotic cattle cannot be extended, grading up of local cattle with superior bulls of breeds like Hariana, Sahiwal, Sindhi, Tharparkar, Kankrej etc. should be attempted with a view to helping farmers to replace progressively their low producing cattle by general utility type animals.

28.9.9 In tracts where there are specialised draught breeds of cattle like Nagori in Rajasthan, Amritmahal and Halikar in Karnataka, Deoni in Maharashtra, selective breeding for draught quality should be promoted on a large scale as the cattle breeders in these areas derive a large income by sale of good quality bullocks. Planned efforts should be made for improving the draught capacity as well as ensuring uniformity in the cattle population in these breeding tracts. We would like to reiterate the recommendations made in our Interim Report on Desert Development that the ICAR and agricultural universities in the concerned States should intensify investigations to develop yardsticks for objective assessment of draught capacity in bullocks.

10 ARTIFICIAL INSEMINATION

28.10.1 Isolated attempts to try artificial insemination (AI) in cattle were made in India since 1939. However, planned and comprehensive studies on AI with special reference to the Indian conditions were initiated in 1942 at the IVRI under a scheme sponsored by the ICAR. Under this scheme various aspects of AI such as collection and preservation of semen, techniques of insemination, transport of semen to rural areas were studied. These studies indicated that the method could be introduced in the country without much difficulty. It was, however, deemed essential to use it extensively under representative field conditions before recommending the technique for general adoption. With this in view, four regional centres were established by the IVRI at Montgomery, Calcutta, Patna and Bangalore. The results of work indicated that AI could prove an important and effective tool for bringing a rapid improvement in cattle. Consequently, the Animal Husbandry Wing of the Board of Agriculture and Animal Husbandry in India at its Seventh (1946) and Eighth (1949) meetings recommended that extensive use of AI for genetic improvement should be attempted and that State Government should open AI centres in selected areas having high density of cattle population and satisfactory transport facilities. It was further recommended that in order to make AI effective it would be desirable to ally sterility service with it and that practical instructions in AI should form part of the college curricula in all the institutions where training in animal husbandry was imparted. In response to these recommendations the technique of AI was introduced in majority of the States. Under the All India Key Village Scheme, setting up of AI centres formed an integral part of the technical programme of each block. AI centres were gradually started under the Community Development and National Extension Service blocks, in veterinary hospitals in urban areas, veterinary colleges etc.

28.10.2 In the initial stages, the following main difficulties were experienced in the application of AI on a field scale.

- (i) People were hesitant to get their animals artificially inseminated and preferred natural service;
- (ii) Due to lack of knowledge regarding the reproductive functions in animals most of the animals were not brought for insemination at the proper stage of oestrus; and
- (iii) Farmers were reluctant to take their animals over long distances to get them inseminated.

In view of the above mentioned factors, the number of inseminations done and the rate of success achieved varied considerably in the

different Key Village blocks functioning in the various States. In some States like Andhra Pradesh, Maharashtra, Karnataka and West Bengal the advantages of AI were better appreciated and the States started large AI centres, while the tendency to have small AI centres continue in Uttar Pradesh, Tamil Nadu, Punjab, Rajasthan, Madhya Pradesh etc. However, with the experience gained in the adoption of AI in the last two decades or so and improved communication facilities now available even in the rural areas, we consider it advisable that large size AI centres should be organised on district or regional basis. This would result in economy in the maintenance of bulls and ensure their fuller utilisation. Each of these centres should have a well-equipped laboratory manned by adequately trained specialists, staff and have facilities to undertake quick and efficient collection, examination and storage of large number of semen samples. Further, we recommend that each district should have one large semen collection centre catering to the entire needs of AI in the district. In such of those districts where communication facilities may not be satisfactory, two or more semen collection centres, each to cater to about 50 to 100 sub-centres, may be set up.

28.10.3 A questionnaire on the AI programme was sent by us to all the States asking for information on the technique adopted, training of personnel and suggestions for improvement (Appendix 28.5). The information received from the State Animal Husbandry Departments, Veterinary Colleges, IVRI, NDRI and other institutes participating in the AI programme has been broadly reviewed in the following paragraphs and suggestions are given to make the programme a better success.

28.10.4 Dilutors : For extending semen a large number of dilutors are being used at present. Different dilutors are being used in different centres. Even within a State different types of dilutors are being used at different AI centres as the responsibility of preparation of dilutors has been generally left to the officers in charge of the individual centres. The facilities existing for proper preparation of dilutors vary and the constituent chemicals are obtained from different sources. There has been a tendency on the part of the officers in charge of the centres to try different dilutors on experimental basis on their own. Through these trials it is the farmer who stands to suffer if these extenders prove less successful than the conventional dilutors of proven value. We, therefore, recommend that new dilutors should not be used on field scale without proper trials under controlled conditions at a research institution. In countries where AI technique is being adopted on an extensive scale even large AI centres obtain standard semen extenders from reputed commercial firms which produce these extenders with

great care. Until such time when preparation of extenders is taken up on a large commercial basis, we consider it advisable that the State Departments of Animal Husbandry should arrange for centralised manufacture of approved dilutors in well-equipped laboratories. The desirability of designating one of the centralised semen laboratories in a region and entrusting the responsibility of manufacturing and supplying extenders to different AI centres should be explored. Such a procedure would enable preparation and supply of a standard type of dilutor. This would stop the officers in charge of the individual AI centres from making dilutors on their own and also from trying new ones. Each State Department of Animal Husbandry should advocate the use of only one type of dilutor in a region and the same should be continued till such time the research workers in the State recommend a better substitute after controlled experiments both under laboratory and field conditions. Replies received from the States in response to our questionnaire indicate general acceptance of these principles.

28.10.5 Semen evaluation : The tests and procedures adopted for evaluation of semen at AI centres not only vary from State to State but differ even within a State. We recommend that uniformity of procedure both for routine and periodical testing should be laid down by each State Department of Animal Husbandry so that it may be possible to evaluate and compare the results achieved in different centres/States.

28.10.6 Transport of semen : In most of the States the semen is despatched to the insemination units on every alternate day. In Uttar Pradesh, Delhi and in some AI centres of a few other States, semen is despatched to the insemination centres only twice a week or even at longer intervals. It is quite likely that the quality of semen used at village level in such places may not be good enough for obtaining a satisfactory conception rate. This may be particularly so in respect of extended buffalo semen. In the western countries even when diluted chilled semen was being used, efforts were made to despatch semen to the AI technicians almost every day. In our opinion, it is necessary that in order to maintain a satisfactory level of conception rate semen from AI centres should be despatched daily or at the most on alternate days. However, in areas which are not easily accessible and semen cannot be supplied even on alternate days, the sub-centres should be provided with small sized refrigerators.

28.10.7 In the earlier years when the coverage under AI programmes was limited, distance over which semen was to be transported from the collection centres was comparatively short. As such, transport of semen could be arranged through messengers who carried the semen shippers/flasks either on bicycle or on foot. As the area covered under

AI centres is being extended progressively and the centralised semen collection through the establishment of regional AI stations is being taken up, the need for long distance transportation of semen has arisen. Means of transport such as aeroplane, bus, jeep, motorcycle, train etc. are now being used. In a few centres, milk collection motor vehicles of the dairy projects are being utilised for this purpose. As improved breeding of dairy cattle would be mostly concentrated in the milksheds of dairy projects and the functions of milk production, its enhancement and milk marketing would be brought under a single organisational control as recommended by us in Section 7 of Chapter 29 on Dairy Development, it should be possible to make use of the transport facilities of the dairy projects for regular and timely transport of semen from the central semen stations to the village sub-centres. Such a system is already being practised very successfully and with advantage under the Kaira District Cooperative Milk Producers' Union in Gujarat where semen from the AI station is carried in time to a large number of village units by the milk vans almost daily. We recommend that wherever possible facilities of milk collection and transport of the dairy schemes should be availed of for transport of semen. This would not only economise on cost of transport but also help in transport of semen daily and at fixed time.

28.10.8 Training of lay inseminators : With the taking up of intensive projects like ICDP, OFP, crossbreeding schemes and other programmes which envisage breeding of a large number of cattle in selected pockets in the country, the need for extending AI service to cover a large number of villages and cattle population is becoming more and more important. Experience in some of the existing projects has shown that dependence only on Government employed field assistants alone would not be sufficient to achieve this objective. A beginning has already been made under the Kaira District Cooperative Milk Producers' Union in Gujarat and the Indo-Swiss Cattle Development Project in Kerala to train persons with some educational background as lay inseminators. The experience gained so far has indicated that AI work could be entrusted to such lay inseminators without any deterioration in the efficiency of the service. In our opinion the insemination work in the rural areas could be entrusted to properly trained lay inseminators as is done in most of the developed countries. Such a system of entrusting insemination work to village educated youths would enable increased coverage and economy in the provision of AI services.

28.10.9 Fee for insemination service : AI service is at present extended free of cost in most of the States. In Bihar and Uttar Pradesh a nominal fee of 25 and 20 paise per insemination respectively is charged. AI has been provided free of cost with a view to encourage

cattle owners to bring their animals for insemination with the semen from improved bulls. Since this technique has now been in vogue for nearly three decades and the value of the service has been realised by the cattle owners, particularly in the milksheds of large dairy projects, the time is now opportune for levying a reasonable fee for insemination services. Apart from the fact that collection of fees would to a large extent help meeting the cost of running of AI centres, it would also instil in the minds of cattle owners the usefulness and the value of the service. Payment of fee would also induce the farmers to expect and demand a more efficient AI service from the projects.

28.10.10 A graded system of levying fees for AI should be adopted in the beginning. A higher fee may be charged in the urban areas while a nominal fee may be charged for inseminations of animals brought to the rural AI centres. For providing insemination service at the door of the cattle owners in the rural areas, special fees should be charged. Insemination fee should be charged for the first insemination only and subsequent two repeat inseminations should be free.

28.10.11 Even though AI has been in operation under a number of schemes and the farmers have by and large come to appreciate the efficiency and usefulness of this technique in cattle and buffalo breeding, it cannot be said that this system of breeding has received wide acceptance by the farmers in all the places or that the insemination services provided are fully utilised under the schemes. The number of AI centres, bulls maintained and the inseminations performed as on April 1, 1973 are given in Appendix 28.6. It will be seen therefrom that only in five States namely, Bihar, Karnataka, Tamil Nadu, Punjab and West Bengal annual inseminations done per bull exceeded 1,000. In Assam, Madhya Pradesh, Himachal Pradesh, Nagaland, Rajasthan, Andaman and Nicobar Islands and Delhi the number of inseminations was less than 500 per bull. The number of inseminations per unit/sub-centre exceeded 500 only in Tamil Nadu and Chandigarh. In most of the other States this was less than 250. In our opinion, the minimum number of inseminations per bull and the number of inseminations per AI centre should be 2,000 and 1,000 respectively. The low breeding coverage under the AI centres has been engaging the attention of the State Animal Husbandry Departments which have been trying to improve the facilities regarding transport, equipment, etc. with a view to ensuring larger breeding coverage. In all the cattle and buffalo development programmes under the successive Five Year Plans, AI formed an integral part of the technical programmes for improvement of quality and productivity of these animals. It was brought to our notice that farmers in some areas had a grievance that bulls were withdrawn in areas served by AI centres but the facilities for providing

timely and effective artificial breeding service were not adequate. Under these circumstances, we recommend that the Animal Husbandry Division of the Union Ministry of Agriculture and Irrigation should arrange for investigation by the States of the causes for poor response to AI and suggest on the basis of such a study, measures for increasing breeding coverage through the AI centres.

28.10.12 Improvement of breeding coverage : One factor which stands in the way of increasing the number of artificial inseminations in the rural areas is the large number of scrub bulls. Even though most of the State Governments have enforced the Livestock Improvement Act which empowers mandatory castration of all unapproved bulls in the area covered by different cattle development schemes, scrub bulls are still being maintained by the farmers. It will require a massive effort on the part of the extension staff to convince the farmers on the need and importance of removal of scrub bulls from villages. We recommend that the AI centres should maintain superior quality bulls, preferably proven sires where available, with a view to convincing the farmers of the advantages they will derive by breeding their cows and buffaloes with such bulls. Adequate number of bulls should be maintained at each AI centre to ensure regular despatch of high quality semen. As recommended earlier in paragraph 28.10.6 the semen should be despatched, if possible, every day or every alternate day to the insemination units/sub-centres. At present each AI unit/sub-centre in the rural areas is expected to cover 1,000 breedable cow and/or she-buffalo population which in certain areas may be spread in one or more villages within a radius of three to four kilometres or even more. In such cases the farmers are reluctant to take their animals over long distances, and even if they want to do so, they are very often not able to bring their animals at the proper stage of oestrus for insemination. In some States the stockmen are expected to do inseminations in more than one location with a view to reducing the distance over which animals are to be brought. Even if this practice is followed, a stockman can arrange for daily insemination in only two or three places at the most while it is necessary that AI service is available daily in all the villages with high concentrations of cows and buffaloes. It should be ensured that insemination services are available from morning till evening and on all the days in the week so that no owner who brings his cows for service goes back without getting his animals inseminated. In our opinion, wherever possible, arrangements should be made to provide AI service at the farmers' door in villages covered by ICDPs and milksheds of dairy projects.

28.10.13 As the inseminator in the village is the key man on whom the success of the insemination services depends, it is essential that selection of personnel for this work should be made carefully

Only those who have an aptitude for this type of work should be appointed. With a view to keeping up their interest in the profession, sufficient incentives should be provided in the form of awards, prizes and suitable avenues of promotions. It is also necessary to ensure that in the areas where AI is to be introduced, there is concentration of good cattle and the farmers are willing to take to improved techniques of cattle breeding and management. These areas should also be served adequately by dairy extension work under development programmes. Linking up of centres of artificial breeding with projects for milk marketing will provide necessary incentive and interest for breeding better cattle.

28.10.14 In some States the Departments of Animal Husbandry have laid down definite targets regarding the number of inseminations and castrations to be performed by the stockmen/inseminators in their respective areas. Laying of minimum targets of work would indeed be advantageous particularly in areas where AI is introduced for the first time and in areas where work continues to be poor. However, care should be taken to fix reasonable levels of targets taking into consideration the type of animals, feeding conditions and status of their health. Targets should be progressively increased so that the staff appointed is induced to do sufficient extension work and increase the breeding coverage. Incentives may be provided for those who show evidence of special interest and efforts made in exceeding the prescribed targets. Outstanding performance should be suitably rewarded.

28.10.15 Evaluation of conception rate : The value of adoption of AI technique for cattle development on a field scale will depend upon the conception rate obtained. The common system on which the fertility percentage is assessed is based on the information obtained on the non-returns of inseminated animals for re-insemination within 60 to 90 days. From the inception of AI in the country the AI centres were expected to adopt a system of follow up of insemination in a systematic and planned manner. Even as early as 1957 while reviewing the work of AI, the Animal Husbandry Wing of the Board of Agriculture and Animal Husbandry observed that there were great variations in the conception rates as reported by the different AI centres and in some cases the figures were unusually high. The main reason for these variations appeared to be that the method of working out the estimates was not uniform. It was recommended by the Wing that a uniform method for working out the conception rate following AI should be laid down and followed by all the centres. Accordingly, the ICAR circulated such a method to the State Governments for adoption. However, the methods adopted for evaluating the breeding efficiency continued to vary widely not only from State to State but

also from centre to centre within a State. The information received in response to our questionnaire showed that the conception rate was being worked out on the basis of different criteria, such as non-returns, oral enquiry regarding pregnancy, actual physical verification of pregnancy or actual calvings reported. No fixed proportion of inseminated animals was being verified by enquiry or actual examination for purposes of estimating the breeding efficiency. The procedure for recording of inseminations was also found to vary from place to place. In some centres first insemination only was recorded while repeats were not given numbers and repeat inseminations were not taken into consideration while working out the efficiency of insemination. In other centres all the first and repeat inseminations were numbered and included in the calculations for estimating percentage of conception. With such variations in the methods of estimating results of inseminations and in the procedure adopted in estimating percentage of conception, it is not possible to compare the work done at different AI centres nor to compile and analyse data on an All India basis. We, therefore, recommend that a uniform method of recording inseminations, estimation of results of insemination and calculation of percentage of conception should be evolved by the Animal Husbandry Division of the Union Ministry of Agriculture and Irrigation in consultation with the States for adoption.

28.10.16 Training of personnel : A regular training of personnel in AI was first initiated at the IVRI in 1946. A short course extending over a period of 15 days for persons holding qualifications in veterinary science, agriculture or dairying was organised. The duration of the course was extended to three months in 1948. Later a combined course of training in AI and physiopathology of reproduction covering a period of six months was introduced. With the progressive increase in the introduction of AI on a field scale the demand for training of a large number of technical personnel increased and the States also started imparting training in this technique.

28.10.17 The information received from the States in response to our questionnaire indicates that the period of training and the content of training course in AI varies from State to State. Veterinarians are given training for a period of 15 days in Andhra Pradesh, Tamil Nadu and Punjab, one month in Gujarat, Rajasthan and Madhya Pradesh, 6 weeks in Uttar Pradesh and for three months in most of the other States. Similarly, the period of training for stock assistants varies. For example, it is for 15 days in Delhi, Tamil Nadu and Uttar Pradesh, one month in Gujarat, Punjab, Tripura and Manipur, six months in Karnataka and three months in some other States. The NDRI has also specialised training for veterinary assistant surgeons for a period

of one and half months. The curriculum for graduate course in veterinary science/animal husbandry has been revised to include practical and theoretical training in AI and physiopathology of reproduction. Some colleges/universities offer post-graduate diploma and post-graduate degree training in gynaecology and obstetrics, AI and physiopathology of reproduction. As control of sexual health in animals has to be attended to by the same personnel providing AI services, we consider it necessary that veterinary graduates who work as officers in charge of AI centres should have thorough practical and theoretical training in the subjects of AI and physiopathology of reproduction. We consider that intensive training is an important pre-requisite to ensure successful results from field application of AI. A course of training for at least three months as imparted at the IVRI is considered the minimum requirement. Similarly with a view to ensuring sufficient practical knowledge for the stock assistants and field inseminators the training course should be at least for a period of three months.

Frozen Semen

28.10.18 The successful application of deep freezing of bovine semen in the year 1951 brought about a phenomenal change in the field application of AI and for intensive testing, selection and use of sires for breed improvement. In the initial years, dry ice (solid carbon dioxide) was being used as a refrigerant for quickly freezing and keeping semen at -79°C . After the introduction of liquid nitrogen as an effective and safe refrigerant it has almost completely replaced the use of dry ice in the freezing and storing of semen in the western countries.

28.10.19 Organised field use of frozen semen was introduced in India in 1965 under the Indo-Swiss Project, Kerala which was equipped with a frozen semen station. The second frozen semen station was set up under the Indo-Swiss Project at Patiala (Punjab). Small quantities of frozen semen were also obtained by the different State Governments, agricultural universities and research stations for experimental purposes and for undertaking limited crossbreeding trials in cattle at the farms and in the field. A central frozen semen bank was established at Hessarghatta (Kernataka) in 1969 for processing and distribution of frozen semen from bulls of exotic breeds to different States/stations/centres. Danish assistance was obtained to instal a liquid nitrogen plant and to get all accessories such as liquid nitrogen containers etc. Large scale field application of frozen semen was extended by the Bharatiya Agro Industries Foundation, Urlikanchan which organised a frozen semen bank for large scale field use in Maharashtra and with the establishment of four frozen semen stations

with Danish assistance in Bangalore, Bhopal, Gurgaon and Amritsar. Nine more such stations are proposed to be established during the Fifth Plan. The Indian Dairy Corporation (IDC) is contemplating to set up frozen semen stations at a number of places in milksheds covered by OFP. Frozen semen stations are also being set up under the Indo-Australian Project at Gauhati and a New Zealand assisted project at Palampur (Himachal Pradesh). One more frozen semen station is proposed to be started at Visakhapatnam (Andhra Pradesh) under the Indo-Swiss Project. From the foregoing developments, we conclude that the interest in use of frozen semen is gaining popularity. Large scale use of frozen semen may help in the successful adoption of crossbreeding programmes, particularly in the context of shortage of purebred bulls of exotic breeds. The IDC has decided to progressively increase the use of frozen semen technique in their project areas. Introduction of this new technique in AI should be planned in a careful manner. As the technique is highly sophisticated the frozen semen stations should be operated through fully trained technical personnel and should be provided with the requisite facilities in terms of buildings, equipment and livestock. We would, however, like to sound a word of caution that use of liquid semen should not be discarded in a hurry before the practicability of using frozen semen has undergone the test of time under the varied field conditions in the country. It is advisable for each State Government to depute 3 or 4 experienced AI officers for practical training in the organisation and management of frozen semen stations and in the field use of this technique. These trained officers should be entrusted with the responsibility of developing one or two frozen semen stations in their respective States as centres of training. For some years to come, we will have to depend entirely on foreign countries for the supply of equipment, such as liquid nitrogen containers, straws, marking and filling equipment etc. It should, therefore, be ensured that as far as possible standard procedures and equipment are used in freezing and field use of frozen semen. Such a procedure would help in stocking sufficient quantities of spare parts of required types. This would also help in the development of capacities to produce required equipment indigenously or through suitable collaboration arrangements with recognised foreign manufacturers. Such an approach would be feasible only if uniform procedure for freezing and use of semen is adopted throughout the country so that manufacture of large quantities of equipment and stocking of spare parts could be ensured. Apart from the various advantages of the use of frozen semen such as longer storage, need for lesser number of bulls, larger utilisation of available high quality bulls, the technique would prove of special value in ex-

tending AI in remote and interior hill areas where transport of liquid semen cannot be arranged as frequently as required. In such villages the supply of liquid nitrogen container with frozen semen and training of a local person in its use could eliminate such a difficulty as a visit to the village will be necessary only once in 10 days or so to replenish the liquid nitrogen in the container. This has become evident through the success achieved in the use of frozen semen in the high ranges of Kerala under the Indo-Swiss Project and in Almora under the Indo-German Project. We recommend that the feasibility of introducing frozen semen technique in other hill regions of the country should also be explored.

11 CROSSBREEDING WITH EXOTIC DAIRY BREEDS

Review

28.11.1 A few organised attempts at crossbreeding with exotic dairy breeds were made in Government cattle breeding farms during the beginning of the present century. However, these attempts were slowly discontinued probably because crossbreeding with exotic breeds was not recommended by the RCA. We have given in Section 3, a brief history of the gradual shift in the approach to cattle development subsequent to the publication of the Report of the RCA. As more emphasis was laid on enhancing milk production, necessity for taking up crossbreeding with exotic dairy breeds was keenly felt. Consequently, a field trial on crossbreeding was initiated in the late fifties by the ICAR on an experimental basis in the hilly and heavy rainfall areas where the cattle were non-descript and had low production capacity. The work was started in 12 units in different parts of the country with the main objective of determining the optimum proportion of exotic inheritance in the crossbred progeny to attain high level of production under the existing environmental conditions. The results of these trials showed that halfbred Jersey crosses produced between 1200 to 1800 kg of milk in their first lactation under village conditions and as such these could prove reasonably good dairy cows. Another scheme was started in 1963 by the ICAR at Harringhata, West Bengal for evolving a new breed of dairy cattle by crossing grade Haryana cows with Jersey bulls. The foundation stock under this project comprised 400 grade Haryana cows and 10 Jersey bulls. Data in respect of 1045 F_1 and 125 F_2 animals were studied which showed that the milk production level and reproductive efficiency in the crossbreds were superior to the grade Haryana stock.

This scheme was merged in 1968 with a more comprehensive project supported by UNDP, PL 480, Government of India and FAO. This programme included three exotic breeds, viz., Holstein-Friesian, Brown Swiss and Jersey and 1500 grade Haryana cows. In 1972, the whole project was brought under the All India Coordinated Research Project on Cattle. At present the programme is under implementation in seven centres using 3 exotic breeds, viz., Holstein-Friesian, Brown Swiss and Jersey and three indigenous breeds, viz., Haryana, Gir and Ongole. From the limited information available so far, it appears that Holstein halfbreeds would be better milk producers and probably more economical.

28.11.2 The other crossbreeding programmes taken up on a field scale included the Indo-Swiss Project, Madupetty (Kerala), and Patiala (Punjab), Indo-Danish Dairy Project, Hesserghatta (Karnataka) and the Indo-German Agricultural Development Project, Mandi (Himachal Pradesh) and Almora (Uttar Pradesh). The Indo-Swiss Project, Kerala was started in 1963 with a definite and clearcut objective of creating a uniform and stable crossbred cattle population in large numbers with high production potential. The local cattle of the project area and the Brown Swiss breed from Switzerland were selected as parental stock. The breeding programme was based on the assumption that the exotic inheritance which would give satisfactory performance under prevailing environmental conditions would be somewhere between 50 and 75 per cent. In order to achieve this, two groups of male and female crossbreds having 50 per cent and 75 per cent Brown Swiss inheritance respectively were built up and the foundation stock having 62.5 per cent Brown Swiss inheritance was produced by crossing of the halfbred and 3/4th Brown Swiss crosses. In the rural extension areas, it was not considered advisable to produce crossbreds with 75 per cent exotic inheritance. Therefore, a large number of animals having 50 per cent Brown Swiss inheritance were produced and they were inseminated with frozen semen obtained from crossbred bulls having 75 per cent Brown Swiss inheritance which had been produced at the breeding centre. Thus one generation could be skipped in the field programme in obtaining animal with 62.5 per cent Brown Swiss inheritance.

28.11.3 The performance of the various grades of purebreds was analysed by Ramachandran Nair.¹ He observed that the "first lactation 305-or-less-day lactation milk yield averaged 716 ± 760 ., 1958 ± 534 ., 2499 ± 729 and 2121 ± 670 kg for animals having 0 per cent Brown Swiss, 50 per cent Brown Swiss, 75 per cent

¹ Ramachandran Nair, P.N. 1973. *Evaluatory crossbreeding as a basis for cattle development in Kerala State (India)*. Thesis presented to the Faculty of Veterinary Medicine of the University of Zurich.

Brown Swiss and 100 per cent Brown Swiss inheritance respectively. The corresponding average lactation lengths were 167, 293., 305, and 296 days." He concluded that "replacement of indigenous genes with *Bos taurus* genes resulted in an increase of average milk yield to a certain level."

28.11.4 Indo-Swiss Project, Patiala : Another Indo-Swiss Project somewhat on similar lines as the one at Kerala was started in Patiala (Punjab) in 1971. This project aims at production of a new type of dual purpose crossbred animal having satisfactory adaptability to local environmental conditions. When the project was started, it was envisaged that a straightforward crossing of Brown Swiss breed and Haryana/Hissar type of animals, which are predominant in the district, would be adopted. However, after a careful reconsideration it was decided to make use of the Sahiwal herd, which was already available in one of the departmental farms of the State, as a third parental population. This was done with a view to adding the potentials of one of the best Indian milch breeds to the new breed of crossbred cattle proposed to be evolved. In the first phase, the breeding programme envisaged production of crossbred animals in the rural areas with 50 per cent Brown Swiss and 50 per cent Haryana/Hissar inheritance, and production of crossbred parental stock at the project farm with 50 per cent Brown Swiss and 50 per cent Sahiwal blood. In the second phase the crossbreds in the rural areas were to be mated with Brown Swiss-Sahiwal crossbred bulls from the farm to produce animals in the villages with 50 per cent Brown Swiss, 25 per cent Sahiwal and 25 per cent Haryana inheritance. In subsequent generations Haryana inheritance was to be progressively reduced and replaced by Sahiwal inheritance. In the farm, a systematic continuous *inter se* breeding was to be followed for producing a genetically stable crossbred herd from which rigorous selection of 50 per cent Brown Swiss and 50 per cent Sahiwal bulls was to be made at each generation. The experience of the Indo-Swiss Project should be gainfully utilised for planning crossbreeding programmes with clearcut objectives. Otherwise the crossbreeding efforts would result in the production of a heterogenous cattle population on which future evaluation, selection and improvement would be difficult, if not impossible.

Indo-Danish Dairy Project

28.11.5 A model dairy cattle farm was established in Hesserghatta (Karnataka) under the Indo-Danish Project for purposes of demonstration, training and extension. The foundation stock consisted of 90 high quality Red Dane cows and 17 bulls imported from Denmark

in 1961. The strength of the herd was raised to 150 Red Dane cows in 1972. The data obtained from the studies on this herd have shown that superior purebred exotic cattle could be successfully managed in the country in organised farms under skilful management. Under this project, three more breeding centres have been started at Munirabad, Koudike and Dharwar in Karnataka State with a foundation herd of 60 cows each of Red Dane, Jersey and Holstein breeds respectively for demonstration, training and extension purposes.

Indo-German Agricultural Development Project at Mandi (Himachal Pradesh) and Almora (Uttar Pradesh)

28.11.6 These projects though primarily intended for development of crop production in the districts of Mandi and Almora also included small scale programmes for improvement in the quality of cattle through crossbreeding with breeds of cattle from Germany. In Mandi a nucleus herd of 25 heifers and 8 bulls of German Highland Spotted breed was imported. Crossbreeding of cattle with bulls of this breed is being undertaken using liquid semen at a number of AI centres in Mandi district. In Almora, the project provided assistance for importation and use of frozen semen from Brown Swiss bulls for crossbreeding of cattle. A number of crossbred cows have come into production in Mandi district showing considerably higher milk production than local cows.

ICDPs and other Projects

28.11.7 The Fourth Plan laid great emphasis on crossbreeding of cattle as an important plank for rapid increase in milk production. It was stressed that extensive crossbreeding should be undertaken particularly in the ICDP, Key Village blocks around urban centres and milkshed areas of large dairy projects. Accordingly the State Governments decided that in all the ICDPs excepting those located in the breeding tracts of the improved indigenous breeds, crossbreeding with exotic dairy breeds would be progressively introduced. In the beginning of the Plan difficulties were faced regarding the availability of purebred exotic bulls. These were to some extent obviated through importation of exotic cattle of milch breeds through the assistance of international agencies and through bilateral inter-governmental agreements.

28.11.8 The information collected from the States on breeding coverage has shown that about 1000 purebred exotic/crossbred bulls are being used for AI in the different States. Most of these bulls are

stationed under the ICDPs. Considering the large breedable cow population in the ICDPs, the number of exotic and crossbred bulls used for AI is too small. We have made a general assessment of the working of the ICDPs on the basis of the replies received from the States and find that although crossbreeding has been accepted as a policy in the ICDPs, it has not been possible in most of the projects to undertake a planned programme envisaging creation of a large population of uniform and genetically stable types of crossbred cows. A large proportion of the cattle under many of the ICDPs still continues to be bred with improved bulls of indigenous breeds with the result that the project areas have more of a mixed population of nondescript cows, graded indigenous cows and crossbred cows with different levels of exotic inheritance. We recommend that in all cattle and dairy development projects and other areas where crossbreeding in cattle has already been started or is proposed to be started in the near future, a clearcut breeding policy should be chalked out. The policy should *inter alia* lay down in advance the exotic breeds to be used, level of exotic inheritance to be reached in the crossbred population and the type of crossbred bulls to be used for *inter se* mating etc. Further, when it is decided to undertake crossbreeding in a project it should be ensured that all facilities are provided simultaneously for breeding coverage to almost all the cows in the area. Otherwise, the project would ultimately be left with a medley crowd of heterogeneous cattle population differing widely in conformity, disease resistance and production.

Choice of Suitable Exotic Breeds

28.11.9 The Scientists Panel on Animal Husbandry appointed by the Union Ministry of Agriculture and Irrigation in 1965 had recommended that bulk of the exotic inheritance should be obtained through Jersey breed and that other exotic breeds like Holstein-Friesian, Brown Swiss and Red Dane should be used to a limited extent in areas where improved feeding and management could be provided. We generally endorse this policy. Jersey breed has been considered more suitable for breeding because of its comparatively smaller size and higher fat content in milk. Where heavier exotic breeds are chosen for crossbreeding greater attention will have to be paid to ensure adequate feeding and management regimes. During the past decade it has been observed that in many tropical countries Holstein-Friesian have progressively replaced Jersey due to large quantum of milk produced in crosses with indigenous tropical breeds. We, therefore, feel that along with Jersey, Holstein-Friesian should also be used where efficient

animal health coverage and adequate supply of feed and fodders could be ensured.

28.11.10 We have studied the measures to be taken for improving the cattle in the hilly regions of the North-Eastern States. In this region we consider, as recommended by us in our Interim Report on 'Some Important Aspects of Livestock Production in the North Eastern States' that the choice of the exotic breed for crossbreeding need not be restricted to the Jersey. Breeds like Brown Swiss and Red Dane which are also good for beef should be used for crossbreeding in these areas. Brown Swiss breed has the additional quality of being a good draught animal in the hills. We recommend that in the hilly areas where beef consumption is popular, heavier exotic breeds should be used for crossbreeding provided grassland development and fodder production could also be augmented in these areas.

Level of Exotic Inheritance

28.11.11 As already suggested in paragraph 28.11.8, clearcut objectives should be laid down while taking up crossbreeding in cattle regarding the level at which the exotic inheritance is to be stabilised in order to ensure the best possible combination of the high milk yielding potential of the exotic breeds and the stamina and hardiness of the indigenous cattle. The experience under the crossbreeding projects in India and other tropical countries has shown that halfbred cattle could be raised successfully and that halfbreds are capable of producing at least 2 or 3 times more milk than their indigenous dams. The mode of inheritance in regard to milk production has been found to be largely due to additive gene action. In some crossbreeding experiments¹ there were indications of heterosis in regard to milk production but the extent of its exhibition is not very large. At the Allahabad Agricultural Institute where crossbreds were back crossed to the indigenous stock, namely, Red Sindhi, it was found that the milk production dropped almost in proportion to the reduction in exotic inheritance. An analysis of the large amount of data obtained from the military dairy farms showed that 5/8 to 3/4 Friesian inheritance would be ideal for milk production under the conditions of management obtained in those farms. In our opinion, the crossbreeding policy to be implemented in the rural areas should broadly aim at producing crossbred stock with 50 to 70 per cent exotic inheritance. Further improvement in milk production in the crossbred cattle should be brought about through the use of selected crossbred bulls and later progeny tested crossbred bulls. In the Himalayan region even

¹ Mc Dowell, R.E. Fertility of commercial dairying with cattle indigenous to the tropics. Bulletin of the Internal Agriculture Development Programmes, Cornell University, Ithaca, New York 14850.

purebred exotic cattle can be successfully raised provided adequate nutrition and health cover are ensured.

Establishment of Herds of Exotic Dairy Breeds

28.11.12 The primary requirement of the projects undertaking crossbreeding programme is the continued availability of high quality purebred bulls of exotic dairy breeds in sufficient numbers for the AI centres of the projects. To meet this requirement Government of India has been arranging for the importation of purebred exotic dairy cattle. The information obtained from the Animal Husbandry Division of Union Ministry of Agriculture and Irrigation has shown that 4301 exotic cattle were imported from 1961 to 1974. The bulls were generally stationed at the AI centres and breeding farms and the heifers were used to build up foundation herds in different States. Some exotic animals were also received by private individuals and institutions from organisations abroad.

28.11.13 Under the Fifth Plan it has been proposed to establish 10 to 12 large exotic cattle breeding farms with a foundation herd of 300 cows/mature heifers. For genetic improvement in the existing herds and those to be established in future, frozen semen from high index bulls would be obtained from abroad in the initial years. Later on a programme of progeny testing of selected bulls at the farm and in the field would be undertaken. We recommend that the proposed new farms should be established in the States where there are no large exotic herds and where progressively more and more areas would be brought under crossbreeding programmes. When all these farms are fully established we expect that the annual production of bulls of exotic breeds would be of the order of nearly 1000. This should be sufficient to meet the requirement of new crossbreeding programmes and replacements in the existing projects. Purebred exotic bulls would be required in a project area only for six to eight years, by which time all the indigenous cows would have received two or three rounds of breeding through AI and sufficient number of crossbred progeny would have been produced to replace the parental stock. Thereafter the projects would need only suitable crossbred bulls for *inter se* breeding for stabilising the exotic inheritance at the required level. When such a stage is reached in a crossbreeding project area, a large proportion of the purebred bulls from there could be easily transferred to new project areas where crossbreeding is to be commenced. Further, we anticipate that frozen semen technique, if properly practised, would progressively replace liquid semen use. This would help in increasing the breeding.

coverage from each bull, thereby reducing the requirement of pure-bred exotic bulls.

Crossbred Bulls for *inter se* Breeding

28.11.14 The objective of each crossbreeding project should be to ensure that the exotic inheritance in the crossbreds is stabilised and maintained at the desired level. This could be possible only if the breeding centres of the project are able to obtain the required number of crossbred bulls of the desired quality. If the policy in a State is to use crossbred bulls having exotic inheritance from a particular exotic breed and an indigenous breed, it would be necessary for that State to have a planned breeding programme implemented in one of their large farms for producing crossbred foundation stock with the required level and type of exotic and indigenous inheritance. A stabilised crossbred herd should then be developed through selection of cows and bulls for *inter se* mating. The Indo-Swiss projects in Kerala and Punjab and the one proposed for Andhra Pradesh have this approach built in the project's technical programme with a view to developing an improved and uniform herd of crossbreds. These projects could produce and supply a number of crossbred bulls for *inter se* mating of crossbred cow population in the project area and to grade up cattle in the periphery and adjacent areas. Till the States are able to develop and implement a programme as detailed above for producing the required type of crossbred bulls from within the State, maximum use of crossbred bulls that are available from the experimental crossbreeding projects in operation at the National Institutes like NDRI, IVRI and the Centres of the ICAR Coordinated Cattle Breeding Projects and various agricultural universities should be made. Under these projects bulls or frozen semen from exotic bulls with high index for milk production are being used on high yielding cows of indigenous breeds. As such crossbred bulls produced at these centres are expected to possess superior genetic constitution for milk production and they would be better genetically than the crossbred bulls that are produced in rural areas out of low yielding nondescript dams. Since military dairy farms have got good herds of crossbred animals with various exotic inheritance, it should be possible to select a large number of crossbred bulls of the desired quality from these farms also.

28.11.15 After obtaining fairly large number of crossbred cows having a definite level of exotic inheritance, it would be necessary to maintain that level over generations to obtain a genetically stable

crossbred cattle population. Efforts should also be made to improve upon their milk yield. This could be achieved if progeny tested sires with the same genetic constitution are continuously used for breeding. Hence programmes will have to be evolved to undertake progeny testing of such bulls at the farms as well as at field level. It would be necessary for a small group of animal geneticists to define the mechanics of undertaking a systematic testing of bulls used in the crossbreeding areas. Specialists may not be available to supervise the implementation of the programme. It would, therefore, be advisable to associate the experts available in the national institutes like NDRI, IVRI, IARS and the agricultural universities and the National Dairy Development Board.

Import of Exotic Cattle by Individuals/Private Institutions

28.11.16 One major constraint in the importation of livestock had been the high rate of customs duty levied on them. This had proved a disincentive in the acceptance of even gift supplies of breeding stock by local institutions from donor parties abroad. Realising the need for liberalising importation of exotic livestock in large numbers for breeding purposes the Government of India exempted import of livestock for breeding purposes, frozen semen and equipment for handling frozen semen from payment of customs duty. There has still not been any perceptible rise in the import of cattle by individual breeders in recent years. We have been informed that there are a number of Indian settlers abroad belonging to farmers' families who can be induced to buy and send good dairy cattle to their relatives at home. The Punjab Government has been considering incentives for such importation but no firm proposals have yet been finalised. We are of the opinion that two incentives should be given to encourage importation of dairy cattle through individuals of Indian origin who have settled abroad. Firstly, the Government of India may provide the foreign exchange to meet the cost on transport of animals from abroad which could be recovered on 'rupee payment' basis from the recipients. Secondly coordination of work relating to collection of animals in foreign countries, their transportation and distribution to their respective recipients in India after inspection, quarantine and prophylactic vaccination may be undertaken by the Government. The first concession would encourage such of those settlers abroad who would like to utilise their foreign exchange to meet the cost price of animals but may not be willing to spare foreign exchange to meet the transportation charges. The second facility will minimise the cost on transport and thus encourage the import

of exotic animals. The coordinating agency of the Government of India could collect the animals at one point and arrange for their transport in full plane loads through chartered flights. Receipts of animals at the port of disembarkation, quarantine and prophylactic vaccinations and internal transport should be arranged by the Government on behalf of the recipient parties.

Crossbred Bullocks for Draught Purposes

28.11.17 Crossbreeding of cattle with exotic dairy breeds does not find favour with some sections of people on the plea that while the crossbred females are good milkers, the crossbred males are not suitable as work animals. While making this assertion they usually compare crossbred bullocks with those of the pure indigenous draught breeds which have been specially bred for generations for improved draught quality. Such comparisons though valid cannot be used for generalisation. Study of the composition of cattle in India would indicate that the number of animals belonging to superior draught breeds is very small while the nondescript cattle are about 75 per cent. Crossbred bullocks are certainly better in their work capacity than the nondescript type of bullocks maintained by the bulk of farmers. Our enquiries have shown that in a number of States like Kerala, Andhra Pradesh, Tamil Nadu, West Bengal, Assam etc. the crossbred bullocks have been found to work much better than the nondescript type of bullocks which predominate over large areas in these States.

28.11.18 The NDRI, Karnal has been using crossbred bullocks for a number of years for pulling heavy carts and for cultivation. Experiments conducted at the Institute showed that the crossbred bullocks were as good as the Sahiwal bullocks during the cooler months for various farm operations. However, during hotter months the crossbreds required more frequent rest as the atmospheric temperature had a marked effect on the working capacity of these bullocks. These studies also indicated that the crossbred bullocks as compared to the Haryana bullocks performed 17, 10 and 7 per cent less work in humid summer, summer and winter months respectively. However, the studies carried out recently at Haringhata by the Animal Husbandry Department, West Bengal have indicated that during cooler hours of the day the crossbred bullocks are as efficient as the Haryana bullocks, have a higher speed and plough deeper and wider. Crossbred bullocks could, therefore, be used for draught purposes in the rural areas without much difficulty except during the hot periods of the day in summer. Keeping in view the small size and the poor

draught capacity of the large majority of local cattle, which are mostly nondescript over wide areas of the country, we are of the opinion that there will not be any danger of losing work efficiency in bullocks as a result of introducing crossbreeding in cattle with exotic dairy breeds in the rural areas. In fact this should result in enhancement of the total draught power in the country from this source.

12 THE BUFFALO

28.12.1 The buffalo is found in the wild, semi-wild and domesticated types. In all the countries where domesticated buffaloes are found, they are valued as triple purpose animals for milk, work and meat. The relative importance attached to these qualities of the buffalo differs considerably in different countries. For example, in the vast paddy growing areas in South East Asia, the buffalo is prized most for paddy cultivation as it is the mainstay for agricultural operations. In some of the countries in Middle East the buffalo is valued almost equally for all the three qualities. However, because the necessity of using the buffalo for work or milk production is more pressing, the meat is usually obtained when the useful life of the animal for other two purposes has ended. In some European countries like Bulgaria and Italy, the buffalo is valued more for milk and meat and less for work. Besides being the principal dairy animal, the buffalo is the main source of meat in Nepal. In India, the bulk of milk produced comes from the buffalo. The importance of the animal for work is also considerable though it is not to the extent as that of bullocks. The meat potentiality of the buffalo remains virtually unexploited so far.

28.12.2 In spite of the fact that the contribution of the buffalo to the agrarian economy is quite substantial, the animal had remained neglected till very recently. Research and developmental efforts for improving the productivity of the buffalo have been meagre as compared to those for cattle. Much more research studies remain to be made to acquire fuller knowledge about the buffalo concerning its genetics, reproduction, nutrition, adaptability, management and the husbandry practices most suitable for locations varying in agroclimatic conditions. But all the same, it is now realised that the dairy buffalo possesses many characteristics similar to the dairy cow. Hence the methods of breeding, feeding and general husbandry for milk production and milk recording that have proved useful for dairy cattle could be applied with equal advantage for development of the

buffalo as a dairy animal.

28.12.3 There are certain aspects of reproduction, nutrition or physiological adaptation which differ in the buffalo from cattle. These may pose peculiar husbanding problems that would require a different approach than that followed in cattle for finding suitable solutions. With more studies on the buffalo it would no doubt be possible to develop more efficient buffalo husbandry.

Breeds and Types of Buffaloes

28.12.4 Till recently it was customary to classify the buffalo in two broad groups, the swamp and the river buffalo. The buffaloes in India are of the river type and a publication by the Council of Scientific and Industrial Research makes a mention of seven breeds of Indian buffaloes.¹ Breed classification of Indian Livestock is not satisfactory and it is very much so in case of the buffalo. Proper information on various aspects including body weights, body measurements etc. and general description is either not available or when available, there is considerable discrepancy. It is recommended that a fresh review and a study in greater depth is made on breed classification of Indian buffaloes for a more satisfactory reclassification of the buffalo stock. The number of buffaloes that conform to any of the breed type is very small in the buffalo population in the country. Vast majority of the buffaloes are unimproved, nondescript animals varying greatly in size, body weight, body conformation and general features as also in milk production.

28.12.5 All the buffalo breeds in the country have been evolved with consideration of milk production characteristics and thus constitute only milk breeds. We are of the view that it would be in the best interest of the country to develop the buffalo not only for milk production but also as a meat animal. The objective of planning for development of the buffalo for the future should, therefore, be not only the enhancement of milk production which is at present its primary function but also the development of the animal for production of quality meat. Attempts at improving the milk quality of all the buffalo breeds seem unnecessary.

28.12.6 Murrah is the highest milk yielding breed. Surti has also good milk qualities. We are of the opinion that for improving the milk quality of the buffalo major emphasis may be laid on the improvement of only the two breeds, viz., the Murrah which would

¹ *The Wealth of India*. Volume VI, pp. 19—21. Publication and Information Directorate, Council of Scientific and Industrial Research, New Delhi.

include Nili, Ravi and Kundi and the Surti. These breeds have attained not only all India importance but also international recognition as two important milk buffalo breeds. It is not unlikely that the Murrah and Surti which have been recommended for development as milk breeds would prove suitable as dual purpose breeds for both milk and meat production. Under the present prevailing conditions, attempts at development of two distinctly separate 'breeds' or 'types' of buffaloes one for milk and the other for meat do not seem to be advisable.

Buffalo Population and Trends

28.12.7 In 1974, the buffalo population in the world was estimated to be nearly 140 million.¹ During the last quarter of a century the buffalo population has grown over 300 per cent though a declining trend can be noticed in European countries. Nearly 50 per cent of the world's buffalo population is found in India. In Appendix 28.7 world distribution of buffaloes and their contribution to milk production have been shown. It will be seen from the appendix that in 19 countries, buffaloes contribute a share in milk production in varying measures but in six of these, viz., India, Pakistan, Thailand, the Philippines, Nepal and Egypt the major share in milk production is contributed by the buffalo.

28.12.8 Some comparative studies of cattle and buffalo population in India clearly bring out the importance of the buffalo as a dairy animal and its increasing popularity with the increased drive for enhancement of milk production. The population of cattle and buffaloes as enumerated in the livestock census quinquennially is shown below beginning from 1940.

Category	1940	1945	1951	1956	1961	1966	1972	Percentage increase			
								col. 4 over col. 2	col. 6 over col. 4	col. 7 over col. 6	col. 8 over col. 7
1	2	3	4	5	6	7	8	9	10	11	12
cattle	115.5	111.5	155.2	158.7	175.6	176.2	178.9	34.4	13.1	0.3	1.5
buffalo	32.1	32.0	43.4	44.9	51.2	53.0	57.9	35.2	18.0	3.5	9.4

It will be seen from above that during the period 1940 to 1951 while there was no organised effort at dairy development, rate of growth in population was higher in cattle than in the buffalo, though

¹ Nagarcenkar, R. 1975. *Buffalo as a dairy animal*. Paper presented at the All India Conference of Animal Scientists and Livestock Breeders, held at Punjab Agricultural University, Ludhiana.

there was considerable growth in the population of the latter species as well. In 1951, the First Five Year Plan was launched and progressively greater attention was given for dairy development. During the course of the decade between 1951 and 1961, the rate of growth in buffalo population which was earlier lower than that in cattle, far exceeded it at the end of the decade. The buffalo continued to have a lead on cattle in growth rate in the subsequent quinquennia as well. Of the total bovine population enumerated in 1972, cattle population constituted 75.5 per cent whereas the buffalo formed only 24.5 per cent. Even with this lower population ratio, the buffalo contributed over fifty per cent in the milk output in the country.

28.12.9 Some of the States like Andhra Pradesh, Gujarat, Haryana and Punjab are important milk producing States. In all these States the proportion of buffalo in the total bovine population is considerably higher than the all-India ratio. Among the leading States in milk production, Haryana and Punjab contain buffalo population exceeding that of cattle (Appendix 28.8). The relative importance of the buffalo as a dairy animal in the country also becomes obvious when the number of lactating animals in relation to the total female population in this species and in cattle, as shown in Table 28.5, is examined.

TABLE 28.5

Number of Lactating Animals in Cattle and Buffalo in Relation to Total Female Stock

Census year		Total females	In milk ('000)	Percentage of milk
1951	C	49,873	18,960	38.00
	B	21,850	10,217	46.75
1956	C	49,903	20,099	40.27
	B	22,352	11,819	52.87
1961	C	54,204	20,667	38.12
	B	25,023	12,463	49.80
1966	C	54,720	20,974	38.33
	B	26,160	12,924	49.43
1972	C	56,773	22,180	39.06
	B	29,553	15,224	51.51

C = Cattle

B = Buffalo

Source : All India Livestock Census of 1956, 1961, 1966 and 1972.

It will be observed that in case of cattle, out of the total female stock, the number of animals that were in milk in different years was

around 40 per cent whereas in buffaloes it was about 10 per cent higher, indicating its superiority as the dairy animal.

28.12.10 Examination of the proportion of over 3 year female stock of cattle and buffalo in the respective total population of the two species in different quinquennia and in different States shows that it is consistently higher in the buffaloes than in cattle (Appendix 28.9). This implies the greater dependence on the buffalo as the source of milk supply.

Buffalo and Dairy Development

28.12.11 The importance of the buffalo as the major source of milk in India was recognised as early as 1928 by the RCA. In the Report of the Commission it was stated that buffalo milk with higher fat content had a good market and that "wherever an important market for butter and *ghee* exists, it is the she-buffalo which mainly supplies it." The RCA further pointed out that while seeking an index of milk production of a province it is the number of she-buffaloes and not the number of cows that should be taken into consideration. The Commission observed that compared to the cow the she-buffalo was tended with greater care by the farmer's family and quite frequently careful selection was exercised in breeding the buffalo. In their recommendation the RCA emphasised that there should be no relaxation in the efforts to improve the buffalo.

28.12.12 The average annual milk production per buffalo in India is estimated at 504 kg as against 157 kg in the case of cows.¹ There are a number of reports indicating the high milk yielding potential of buffaloes in India. In well managed herds average yields ranging from 1,450 litres to 2,340 litres per lactation have been reported. Average lactation yield of over 1,820 litres is obtained from the 15,000 Murrah buffaloes in the Aarey Milk Colony in Bombay. Individual yields of 4,500 litres or more are known.² According to a recent analysis of milk production data on buffaloes, 0.18 per cent of buffaloes in India have a daily milk production of over 12 kg. An earlier estimate had indicated that 0.10 per cent of buffaloes were producing 12.6 to 14.4 kg milk per day.³

28.12.13 Crossbreeding of indigenous cattle with high milk yielding exotic breeds offers possibilities of getting spectacular improvement in the lactation yield of the cow. In consideration of the urgency in

¹ Daroga Singh, Murty, V.V.R., and Goel, B.B.P.S. 1970. Monograph on estimation of Milk Production. Indian Agricultural Research Statistics (Indian Council of Agricultural Research).

² Kay, H.D. 1974. Chapter 13 on Milk and Milk Production in the FAO publication entitled the husbandry and health of the domestic buffalo. p. 336.

³ Cited by W. Ross Cockrill in the paper presented at the XIXth International Dairy Congress.

achieving a rapid increase in milk production, it has, therefore, been accepted as a national policy that this breeding procedure would receive the main emphasis for milk production enhancement in the country. At the same time there is now a growing realisation of the necessity of giving greater attention to the development of milk production in the buffalo than has hitherto been given. With success of crossbreeding in cattle, if the objectives as envisaged are fully achieved, the milk production in the cow can be expected to excel that of the buffalo in the future. Even then, for a long time, if not for all times in the future, the buffalo will continue to have an important place as a useful domestic stock in the country for milk production and other purposes.

28.12.14 Over the years through investigation and research the fund of knowledge and expertise that have been accumulated in the country in fodder crop production, livestock management, feeding and animal disease control are quite substantial. With well planned and sustained application of the available fund of knowledge and technology on a wide scale it should not be difficult to obtain remarkable increase in milk production from the buffalo without increasing the number and even without improving the quality of the existing stock. It is, however, not possible to attain that success in milk production enhancement within a short period of time in a vast country like India only through improvement of husbandry practices. But it is possible to telescope considerably the time scale to achieve the objective if along with improvement of husbandry, an effective breeding programme is undertaken. Large scale use of semen from top quality buffalo bulls on ordinary farms and small holdings would greatly assist in bringing about widespread improvement in the milking characteristics of the buffalo stock with resulting higher output of milk within a relatively short period of time.

28.12.15 The best milk breeds of buffaloes are located in India. Hence there is no possibility of introduction of superior exotic inheritance for milk production enhancement of the buffaloes in the country. With the existing range of individual variation from a few hundred to 4,500 litres or more of milk production it is obvious that there is great scope for bringing about genetic improvement of the buffalo stock. The success of the breeding programme is dependent on the skill of the animal breeder in identifying the superior bulls and on organisation of an efficient artificial insemination service.

28.12.16 Provided the available knowledge in the country is suitably applied and the farmers are encouraged by proper incentives, the national average milk yield of the buffalo could reasonably be expected

to exceed 2,000 litres in a lactation within a span of fifteen to twenty years. We feel that both the official and non-official organisations concerned with dairy development should put in all possible efforts to achieve such a target of milk production in the buffalo, which is a distinct possibility, with a time bound programme.

28.12.17 The programme for development of milk production in the cow and simultaneous organised large scale drive for milk production enhancement in the buffalo are not conflicting. The necessity for milk production enhancement is so great that all production potentials should be actively exploited for obtaining the maximum possible yield. We, therefore, recommend that considerably greater attention than what has been given so far should be directed to the buffalo without delay for milk production enhancement. This would require enlargement and strengthening of the existing programmes as also initiation of additional programmes. The action to be taken in this direction should include establishment of select buffalo herds of adequate size with a concerted drive to collect superior quality animals from various scattered sources. Carefully planned systematic breeding programmes including that of progeny testing of selected bulls should be undertaken in these farms for progressive genetic improvement of the stock. The efficiency of the existing artificial insemination service needs to be improved to a considerable extent. The service also needs to be made easily available on a more extensive scale. Milk recording system is at present far from satisfactory. For success in milk production enhancement programme creation of a dependable milk recording system is an inescapable necessity.

Reproduction in the Buffalo

28.12.18 Opinion is divided on the relative reproductive efficiency of the buffalo and the cattle. There are conflicting reports concerning the superiority of one species over the other. Some are of the opinion that given proper nutrition and management, there are no significant differences of any practical importance in the breeding efficiency of the two species. Late maturity and long intercalving periods are not problems peculiar to the buffalo. These are common phenomena for both cattle and the buffalo in the country. Considerable amount of well-planned research studies are necessary to establish to what extent these phenomena are due to faulty husbandry practices or to the genetic characteristics of the respective species. There is, however, almost near unanimity concerning the difference in the oestrus pheno-

menon of the buffalo and the cow and more marked seasonality in breeding in the buffalo.

28.12.19 Oestrus symptoms are less pronounced in the buffalo and many onsetting of heat may go unnoticed unless great care is exercised in detection. The incidence of silent heat is also more common in the buffalo than in the cow.¹ Problem of detection of heat varies from species to species and with studies on animal behaviour suitable husbandry practices have been developed for different species for detection of oestrus. For obtaining satisfactory results in artificial insemination timely detection of oestrus is essential. In view of the great importance of the subject in relation to the breeding of buffaloes, we recommend that in research studies on reproduction of the she-buffalo, study of animal behaviour during oestrus and oestrous characteristics should be included, wherever possible. This should be done with the particular objective of developing practical husbandry methods for accurate and early detection of the phenomenon.

28.12.20 Marked seasonality in the breeding of the buffalo has been reported by many workers from many countries. The phenomenon was first reported in India² in 1932 and since then many such reports have been obtained. A series of studies initiated in early sixties by a team of research workers at the Veterinary College at Mathura have yielded very valuable results. These findings can be used with advantage in evolving practical husbandry methods to obtain satisfactory conception rate during the period earlier considered as the off season for breeding of buffaloes. The research team was conscious of the fact that there still remained a great deal more to be known concerning the problem of seasonal breeding of the buffalo and had recommended pursuit of research in several areas of reproductive physiology of both the female and the male buffalo.³

28.12.21 We are of the view that in consideration of importance of research in reproduction and production physiology of the buffalo for development of the species, agricultural universities should draw up detailed research programmes both of short term and long term nature and pursue the same in a sustained and systematic manner. For study on some of the problems a coordinated research programme would be more suitable. At present the ICAR is supporting a co-ordinated research project for investigation on certain aspects of buffalo breeding. Several other problems need such coordinated re-

1 Luktuke, S.N., and Ahuja, L.D. 1961. Studies on ovulation in buffaloes. *J. Reproduct & Fert* 2 : 200-201.

2 Ramanathan, O. 1932. Light and sexual periodicity in Indian buffaloes, *Nature*, Lond. 130 (3274): 169.

3 Roy, A. 1974. Observations on the physiology of reproduction. *The Husbandry and Health of the Domestic Buffalo*. pp. 159-166. Food and Agriculture Organisation, Rome.

search. Depending on facilities available, different sets of selected problems may be undertaken for investigation by different agricultural universities. There need not be duplication of studies in different universities unless that is considered essential for investigation on a particular problem.

Artificial Insemination

28.12.22 As mentioned earlier in paragraphs 28.12.17 and 28.12.18, there is more marked seasonal variation in breeding efficiency of the buffalo than in cattle and that in buffaloes there is high incidence of silent heat. These pose problems peculiar to the buffalo in the application of artificial insemination. From investigations on reproduction in the buffalo conducted so far, valuable results have been obtained that offer prospects of minimising the seasonality of breeding in the buffalo and of obtaining better results with artificial insemination.¹

28.12.23 There is a general feeling that the extenders that are commonly used for extending bull semen do not yield as good results when used for buffalo ejaculate. No critical studies have so far been made to study the comparative efficiency of different diluents judged on conception results. The feeling has grown very possibly on the basis of comparative assessment of motility and longevity of life of spermatozoa in extended stored semen. Active research is continuing for evolving a more satisfactory diluent for buffalo semen.

28.12.24 Recent studies at the National Dairy Research Institute have led to the formulation of an extender called 'Citric Acid Whey' which is reported to be very satisfactory for preservation of semen in the liquid state at 5°C as well as in the frozen state. Insemination trials with liquid and frozen semen have given conception rates comparable with natural service.² We recommend that semen preserved in liquid or frozen state in this extender may be tried initially in controlled herds in several other centres in different parts of the country and if found uniformly satisfactory, steps should be taken to extend its large scale use in the field.

Paucity of Superior Quality Stud Bulls

28.12.25 Maintenance of no records is in general the rule rather

1 Roy, A. 1974. Observations on the physiology of reproduction. *The Husbandry and Health of the Domestic Buffalo*. pp 159—166. Food and Agriculture Organisation, Rome.

2 Nagarcankar, R. 1975. *Buffalo as a dairy animal*. Paper presented at the All India Conference of Animal Scientists and Livestock Breeders held at the Punjab Agricultural University, Ludhiana.

than exception in buffalo husbandry practices in the country. Hence it is extremely difficult to identify superior stud bulls for use in artificial insemination programme or for natural service. Milk recording is done in Government farms and the farms of agricultural universities. Most of these farms have small herds. The number of bulls produced is, therefore, small and this is wholly inadequate for meeting the present requirements. In military dairy farms with large size buffalo herds, the male calves are disposed of at a very early age.

28.12.26 According to the information that we had collected from different States, there were in all about 2000 buffalo bulls for use in artificial insemination and about 11,500 buffalo bulls for natural service, maintained under the Key Village Scheme, ICDP projects and in AI centres established by the State Departments of Animal Husbandry in urban areas. Almost all these bulls have been selected on the basis of their physical appearance or at the most on the basis of their dam's milk production. On the assumption that one bull would cover about 1500 female buffaloes by AI and 75 female buffaloes through natural service during the course of one year, it can be expected that organised breeding coverage existing at present would take care of improved breeding of 3.85 million buffaloes. The estimated breedable female buffalo stock in the country is around 25 million. Thus, improved breeding can cover only 15.4 per cent of the breedable stock. This shows the massive gap that exists between the requirement and available number of superior bulls. It is only through identification at the earliest of a considerably larger number of superior stud buffalo bulls and their much wider use through an efficient organisation of artificial insemination that there is a possibility of closing the gap to a large extent if not fully. We feel that this can be possible only through a determined and energetic drive and this should be initiated without delay in consideration of the pressing need for milk production enhancement.

Seed Stock Farms : Progeny Testing

28.12.27 As an aid to selection, progeny testing of bulls and intensive use of the selected bulls through AI is now accepted as the most satisfactory method to bring about rapid genetic improvement in a dairy stock. All these can be achieved only with the existence of a reliable recording system. There is no dependable system of milk recording of buffaloes existing at present in the villages which should form the basis for assessing the improvement achieved as a result of implementation of developmental programmes. If such a system were available that could have served the purpose of progeny testing of

buffalo bulls on a wide scale and identification of superior bulls. As no such system is existing, we recommend that selected Seed Stock Farms should be established for buffaloes in order to assess the genetic potentialities of the breeding bulls with fair degree of accuracy.

28.12.28 In 1966, Ministry of Agriculture & Irrigation initiated a programme for progeny testing of buffaloes with establishment of two buffalo farms in the Central sector ; one for Murrah buffaloes at Alamadhi near Madras and the other for Surti buffaloes at Dhamrod in Gujarat. But these farms that have been established have not as yet come to a stage when progeny testing programme could be undertaken. State Governments of Andhra Pradesh and Madhya Pradesh have also established buffalo farms with the same objective in view. Here also progeny testing programme is lagging behind the schedule. This is a matter of much concern since with delay in establishing a sound uninterrupted programme of progeny testing, it would be futile to expect any rapid appreciable genetic gain for milk production enhancement. In view of the importance of the matter, we recommend that the Union Ministry of Agriculture and Irrigation and the concerned State Governments should make a fresh critical examination of the whole situation with a view to identifying the constraint that are impeding the early implementation of the programmes and take suitable remedial measures. In view of the enormous shortage of superior stud bulls as indicated in paragraph 28.12.25 and the urgency for getting them in large numbers, we further recommend that Seed Stock Buffalo Farms should be created in the States with large buffalo stock and in the Central sector. It would be of advantage to establish Seed Stock Buffalo Farms in the existing military dairy farms where there are a good number of better quality buffaloes.

28.12.29 A number of Seed Stock Farms are necessary also because there must be adequate selection intensity if faster genetic improvement is to be attained in the buffalo. Among the progeny tested bulls the final selection of males will have to be 20 per cent or even lower for use in the Seed Stock Farms. These farms besides making regular, periodic progeny testing of a specified number of bulls will also be producing a number of bulls that could be used with advantage in the lesser developed areas. The semen of the selected bulls located at the Seed Stock Farms, besides being used for contemporary comparison of the performance of the progeny for assessment of their genetic merit, can also be used for improving the production status of the buffaloes in the villages where milk recording must be introduced. Without establishing a system of milk recording in the villages, no reliable assessment of the results of the development programmes can possibly be made. The milk recording programme can profitably be

linked up with a programme of identification of the dams proving superior even when maintained under present husbandry conditions. Male progeny from such dams should be purchased at the age of 6 to 8 months for rearing at the Seed Stock Farms so that these in turn could serve as future young bulls for undertaking progeny tests. A premium price should be paid to the farmers agreeing to sell these animals to the Seed Stock Farms as that would provide adequate incentive to them to cooperate in the milk recording programme.

28.12.30 Because of the limitations of area of cultivable land, irrigation facilities, financial resources etc. as at present found in most of the State and Central Government livestock farms we recommend that the minimum size of the female breeding stock on the Seed Stock Farms should be 150 animals. This was also the recommendation of the panel of scientists constituted for advice in animal husbandry matters for formulation of the Fourth Five Year Plan.

28.12.31 In countries with developed agriculture and livestock smaller size herds can serve the purpose of a progeny testing programme. For example, we are informed that in New York State (USA), a herd size of 60 breedable cows is considered adequate for getting sufficient number of contemporary daughters of different bulls for operation of a reasonably satisfactory progeny testing programme. Beside, the reasons mentioned earlier in the paragraph, the appreciably bigger herd size that we have recommended is based on the consideration of the late maturity, long intercalving period and much lower fertility rate of the buffalo stock as generally observed at present in the country.

Buffalo for Meat

28.12.32 In paragraph 28.12.1, it has been mentioned that the buffalo is a triple purpose animal valued for milk, work and meat. The consumption of buffalo meat had remained confined so far almost exclusively to the buffalo rearing countries that are now striving for development. The buffalo meat consumed in these countries was obtained mostly from animals that had ceased to be useful for work or milk production. The butchering and handling of meat are also unsatisfactory in most of these countries. The meat sold in the market is not chilled and aged properly. Consequently, buffalo meat had earned a stigma of being much inferior in quality than beef or other meats. The unsatiable demand of the meat-hungry world necessitated search for alternative sources of meat and as a result interest in the buffalo began to grow as a possible source of good quality meat. Moreover, the buffalo rearing developing countries have also in

recent years been taking active interest in developing the meat and milk qualities of the buffalo. Some of the developed countries have also started exploring the possibilities of utilising the potentialities of the buffalo as a meat animal. Because of these developments the buffalo has now achieved international recognition as an animal with good potentialities for development for meat production.

28.12.33 In reviewing the research findings on buffalo meat Cockrill¹ stated that "When buffaloes are treated as beef animals and are bred, reared, managed and fed with the objective of slaughter at 12-14 months of age, a quality beef product is obtained. The buffalo is a bovine animal and there is nothing peculiar about its flesh. It does not have a 'buffalo flavour'. It is not a second best to cattle beef, it can stand on its own merits and deserves recognition as meat fit to rank with the best of beef by a meat-hungry but discriminating public. It differs from cattle meat only in having less fat and being more tender." Buffalo meat and beef are closely similar in physical and chemical properties and that in organoleptic properties the buffalo meat is the same as beef.² Palatability tests conducted in Trinidad,³ Yugoslavia⁴ and elsewhere, have shown no differences in palatability between the meat of cattle and buffaloes regardless of the method of cooking. Buffalo meat has frequently been preferred to other samples in the tests. The results of an investigation at the IVRI on meat production characteristics of weaned male Murrah buffalo calves have established that if the buffalo is reared as a meat producing animal with proper feeding and management and is slaughtered at an age around 16 to 20 months excellent quality meat can be obtained. The meat from the buffalo would equal choice beef from the ox both in quality as also in quantity.⁵

28.12.34 In Australia, only about two decades ago, the buffalo was considered useless animal and many people held the view that for development of the land of the buffalo territory for pastoral or agricultural purposes it would be necessary to exterminate the buffalo or to reduce their number to the minimum. A beginning of a small buffalo meat industry was made in that country in 1959 and in the year 1959-60 approximately 2500 buffaloes were slaughtered. It is reported that "in the first part of the 1971-72 season 19,000 buffaloes were slaughtered giving a return of approximately 1,120,000 Australian dollars. The final totals will considerably exceed these figures." "Between

1 Cockrill, W. Ross. 1974. Paper presented at the XIXth International Dairy Science Congress, India.

2 Joksimovic, J. 1969. *Physical, chemical and structural characteristics of buffalo meat*. *J. Scient. Agric. Res., Belgrade*, 22(78), 110-151. Cited by W. Ross Cockrill.

3 Wilson, P.N. 1961. Palatability of water buffalo meat. *J. agric. Soc. Trin.*, 61:457, 459-460. Cited by W. Ross Cockrill.

4 Ognjanovic, A. 1974. Cited by W. Ross Cockrill.

5 Ranjhan, S.K., formerly Head Div. of Animal Nutrition, Indian Veterinary Research Institute—personal communication.

1958 and 1962, a total of 361 buffaloes were shipped live to Hong Kong for slaughter". Buffalo abattoirs have been established in the sixties and two of the buffalo meat works have acquired limited export licence.

28.12.35 It is unfortunate that in India even though it possesses the best buffalo resources in the world the animals had remained neglected for milk production and almost completely for production of meat. The prospects of exploiting the potentialities of the buffalo for production of meat are yet not fully appreciated. This is strikingly reflected in the small calf crop that is saved in the buffalo, particularly that of the male one. Table 28.6 shows the number of animals in milk as also the youngstock in different age groups in different livestock enumeration years.

TABLE 28.6

Population of Youngstock (Buffalo) and Animals in Milk

	(thousand)			
	1951	1956	1961	1966
1. <i>male</i>				
(i) below 1 year	2,863	3,551	4,037	3,966
(ii) between 1 to 3 years	2,380	2,013	2,479	2,437
2. <i>female</i>				
(i) below 1 year	4,172	5,237	5,803	5,893
(ii) between 1 to 3 years	5,262	5,287	6,029	6,286
3. in milk	10,217	11,819	12,463	12,924

Source : All India Livestock Census 1956, 1961 and 1966. Breakdown of figures for 1972 not available.

28.12.36 It can be seen from the table that in comparison with the number of animals in milk, the calf crop as represented by animals below one year is very much lower to indicate high calf mortality. It can also be noticed that compared to the number of female calves the number of male calves is much smaller. It is not necessary to analyse here the various reasons why such a small buffalo calf crop is raised in the country at present. It is well known that the main reason is the economic compulsion of the existing circumstances that makes the buffalo owner find the elimination of the calf more profitable than raising it on mother's milk and expensive feed stuff.

28.12.37 The feasibility of early weaning of buffalo calves and their rearing on cheaper reconstituted milk has been demonstrated in studies in Italy.¹ Limited research studies have been made so far in India on early weaning of buffalo calves and their rearing on low cost calf

¹ De Franciscis, G. 1971. *Early weaning trial in buffalo calves*. casorta, Associazione Provinciale Allevatori, p. 67 (in Italian) cited by W. Ross Cockrill.

starters. We recommend that much greater attention and investigation on a much wider scale should be undertaken in research institutes and buffalo farms to study these problems. The main objectives should be to develop suitable husbandry practices for early weaning of calves and to formulate cheap calf starters with locally available materials that would ensure as good growth as with mother's milk. For promotion of buffalo meat industry considerable research studies are required on fattening of calves for meat and the effect of feed and husbandry on meat quality. Promotional activity for consumption of buffalo meat in the country in larger quantity and consumer educational programme should be undertaken on a countrywide scale. A concerted and energetic drive should also be made to develop export trade in buffalo meat.

28.12.38 The potentialities for development of market for buffalo meat both within the country and abroad are really immense and no other country is in a more favourable position than India for establishing a prosperous buffalo meat industry. World's best buffalo resources are in India. As indicated earlier a number of countries are now taking a very active interest in developing the buffalo for meat with an eye on export trade. We would lose the race in capturing the foreign markets if we cannot utilise the advantage that we possess.

13 MILK RECORDING AND HERD BOOKS

28.13.1 The Royal Commission on Agriculture referred to the successful formation and contribution made by the milk recording societies in other countries and pointed out that even in those countries the cost of inspection and recording was considerable unless the work was carried out over a large number of herds in limited areas. In its opinion such milk recording societies, useful as they may be, would prove too expensive to run under Indian conditions. Some attempts were made to introduce the system of milk recording in selected rural areas during the period preceding the Plans. However, these efforts were limited and did not succeed in popularising the practices even among the owners of purebred cattle in the breeding tracts. Milk recording remained confined only to Government farms and a few organised private herds.

28.13.2 The technical programme envisaged under the All-India Key Village Scheme included recording of milk production in randomly selected samples of the foundation stock as well as their progeny to serve as a yardstick for estimating the progress effected from one generation to another as a result of operation of this scheme. Such a

practice was also anticipated to help the farmers in identifying better animals in their herds for retention and culling out uneconomical and inferior stock.

28.13.3 The Committee on Key Village Scheme considered the progress made on milk recording and found it to be far from satisfactory.¹ It appeared that milk yield information obtained by the staff on many occasions had been written down without verification on actual recording of milk. Several factors were found to be responsible for collection of unverified data on milk yields. For example, it was difficult for the recorder to be present at the time of milking in the very early hours of the morning and the recorders were reluctant to be out of headquarters continuously for six days in a week throughout the year. The plan for selection of animals was also complicated.

28.13.4 Under the ICDPs recording of milk was proposed on the same lines as for Key Village Scheme. As a large number of milk recorders could not be appointed on financial grounds, it was stipulated that the stockmen would undertake milk recording in addition to their normal duties. It is understood that systematic recording of milk is not being practised in most of the projects. In some ICDPs like those at Vijayawada and Hyderabad, milk recording information is collected by stockmen only in respect of the animals located at their headquarters. It is reported that large coverage and reliable data on milk yields are obtained under ICDPs in Gujarat where the projects are being run by cooperative unions. We recommend that the position in regard to milk recording work under the ICDP, Key Village Scheme and other cattle development projects should be studied by a Committee of experts to suggest suitable measures to improve the system as to provide reliable information.

28.13.5 A scheme for 'extension of herd registration to the important breeding tracts and formation of breed societies' was taken up during the Third Plan. The objectives of the scheme were : (a) to locate superior germplasm in the breeding tract through registration and to effect general improvement of the breed through formation of breeders' societies; and (b) to study the production records collected through the organisations set up in the breeding tracts and lay down standards for selection.

28.13.6 Actual registration work started in 1963-64 under a unit established in Rohtak to cover Haryana breed of cattle and Murrah breed of buffalo in the districts of Rohtak, Hissar and Jind in Haryana, Meerut, Muzaffarnagar and Bulandshahar districts in Uttar Pradesh and Sriganganagar district in Rajasthan and the Union Territory of

¹ Report of the Committee on Key Villages. 1961. Ministry of Food and Agriculture, Government of India, New Delhi.

Delhi. Under the Fourth Plan it was proposed to open additional units in Gujarat for registration of Gir and Kankrej breeds, in Tamil Nadu for Sindhi breed and in Andhra Pradesh for Ongole breed. Against these targets, only Gujarat Unit (Ahmedabad) could be started by the end of the Fourth Plan. The Rohtak and the Ahmedabad Units had 54 and 30 milk recording centres respectively. Information collected for the year 1973-74 showed that the number of animals registered per milk recorder was 11 for the Rohtak Unit and 25 for the Ahmedabad Unit. This indicates that the progress of work at both the units has been rather slow and most of the objectives originally contemplated under the scheme have not yet been achieved. However, there has been a progressive increase in the number of animals taken up under milk recording which shows that the breeders have come to appreciate the usefulness and economic benefits of this scheme. This should give encouragement for introducing milk recording practices in more areas in the breeding tracts and the milksheds of the dairy projects. It would, however, be appropriate for the milk recording programmes to be implemented as an integral part of the ICDPs, milk enhancement programme under the OFP and similar cattle development projects. The present arrangement of dual control for milk recording is not working satisfactorily and there is lack of coordination and duplication of efforts. We, therefore, recommend that the milk recording scheme should be administered by a single agency.

28.13.7 The milk recording system should be so designed as to bring under the programme as large a number of milch animals as possible. It would be necessary to adopt owner-sampler systems to cover a large number of owners under the milk recording programmes within the project area. The owners of comparatively larger herds, say having five or more milch animals and institutions like gaushalas and private dairies should be organised on the lines of dairy herd improvement associations in the West. Their animals should be recorded by milk recorders designated by the project according to the approved systems, and on payment of a nominal fee by the owners. The cost on remuneration of the milk recorders, compilation of data and supply of periodical records to the owners may come from the project funds. In villages or groups of villages lying within a radius of one or two miles where sizeable number of milch animals are enrolled for recording, the projects may appoint wholetime recorders. In respect of other villages it would be more economical to utilise on part-time basis the services of educated youth from farm families, school teachers, village level workers, staff of the Panchayat or rural cooperatives. This would help them to supplement their income. Owners of smaller number of animals may be encouraged to adopt the system somewhat similar to the

'owner sampler system' adopted in USA. The supervisory staff of the project should conduct test check on random basis periodically. Milk yield record forms should be supplied gratis to the farmers adopting the 'owner sampler system' during the initial period of three to five years and afterwards on payment of a nominal charge. A programme of organising participant farmers in contiguous groups of villages into herd improvement associations and associating their representatives in the implementation of milk recording programmes and registration of eligible animals in herd books should also be progressively introduced.

28.13.8 Herd Books : Registration of animals in the Central Herd Books was started in 1941 in respect of Sindhi and Sahiwal breeds. By 1949, herd books had been opened for nine breeds of cattle and buffaloes. The rules and regulations laid down were on the lines decided upon at the International Convention of Herd Books held in Rome in 1936. We find that the herd book programme has not been successful in making any significant contribution to the improvement of breeds and in benefiting the herds participating in the programme. A number of States have not registered even a single animal in the herd books. In the case of a few other States which are participating in the programme, the number of animals registered is very small and has been dwindling. It is doubtful if the Central Herd Book Organisation (CHBO) as constituted and functioning at present could be expected to induce individual owners of superior cattle to participate in large numbers. We recommend that the State Governments should promote registration of animals on their own at the State level utilising the facilities created under various cattle development and milk-production projects. The CHBO may take up the responsibility of compiling the data obtained from the States not only in respect of breeds of all-India importance but also of breeds found and registered in more than one State.

28.13.9 Central and State level herd books: In recent years a fairly large number of cattle of exotic dairy breeds have been obtained to raise purebred herds in different States. Such stock has also been imported and multiplied by a few private institutions and individuals. It is anticipated that a sizeable number of exotic cattle would be imported in future either through direct purchase or bilateral/multilateral foreign collaboration projects to strengthen the exotic cattle breeding farms for undertaking scientific breeding for herd improvement. In our opinion a stage has already reached to initiate action for opening herd books for breeds like Jersey and Holsten-Friesian. A procedure may be evolved to register all the imported purebred cattle and adopt restrictive registration in respect of their Progeny based on their dams' yield or on their own production when records become available. Herd books of exotic dairy breeds should be maintained for the country as a whole by the CHBO. Maintenance of the herd books in respect of

breeds like Sahiwal, Sindhi and Tharparkar whose breeding tracts have gone to Pakistan but small herds are available in the country, and of Murrah breed of buffalo may also remain the sole responsibility of the central organisation. For breeds whose breeding tracts are confined to a single State, the concerned State Governments should undertake the work relating to registration and maintenance of herd books. However, to ensure adoption of uniform procedures of inspection, recording and registration, the CHBO may act as the coordinating agency. The registration data should be obtained and compiled at the Centre for the information of national and international agencies.

28.13.10 The crossbreeding programmes would create uniform and genetically stable populations of crossbred cattle in different areas with a definite percentage of exotic inheritance. The CHBO should lay down procedures for milk recording and rules and regulations for registration of such crossbred cattle. Herd books may be maintained by the Centre for an initial period of five years or so. Thereafter these functions should be transferred to the States and the CHBO may keep to itself the responsibility of compilation of data on an all-India basis.

28.13.11 The present organisation in the Union Ministry of Agriculture and Irrigation looking after milk recording and herd book registration of animals is poorly equipped. The programme of work suggested by us will involve detailed work in formulating schemes, working out procedures and details of operations, finalisation of format of records and registers, and laying down rules and regulations. We recommend that the CHBO in the Animal Husbandry Division of the Union Ministry of Agriculture and Irrigation should be headed by a wholetime Registrar of Herd Books who should be assisted by Deputy/Assistant Registrars to look after milk recording schemes, maintenance of herd books and for coordination and supervision of State Herd Book Cells. There would be need to provide access to electronic data processing unit which should be arranged with the cooperation of the IARS/NDDB. Similarly, herd books and milk recording cells should be organised under the State Animal Husbandry Departments to initiate work at the State level under the guidance of the CHBO.

14 PROBLEMS OF CITY MILCH CATTLE

21.14.1 There has been rapid urbanisation, industrialisation and growth of cities during the last two or three decades. The population in cities like Bombay, Calcutta and Delhi has increased considerably and with the high growth rate in urban income, the demand

for milk and milk products in urban and industrial areas has been steadily rising. No organised system for collection of milk from the rural areas and its transport, processing and marketing to meet the consumer needs in the cities existed till the thirties. As such, there has been a regular inflow of milch animals from rural areas to big cities. The city milk supply schemes which were started and developed under the Plans had also not been able to cope up with the ever increasing consumer demand for milk and milk products. As the costs on feeding and management of milch animals in the cities are on the high side, milk suppliers always tried to buy and keep high yielding cows and buffaloes as only such animals could pay for their upkeep and also provide for some margin of profit. The husbandry conditions under which the milch animals were raised in the cities were unhygienic and positively detrimental to breed improvement. This position was brought out in no uncertain terms by Pepperall¹ who pointed out that the city *gawalas* were interested only in getting as much milk as possible from their animals and so they adopted all types of unscientific and cruel practices which would help them in getting more milk during a lactation. When these animals go dry, a large number of them while still at their prime productive stage of life, are disposed of for slaughter. This continuous exodus of good quality milch cattle and buffaloes from the breeding tracts result in the depletion of high quality breeding stock. This problem has been engaging the attention of animal husbandry workers and the general public since a long time. The Government of India appointed a Cattle Preservation and Development Committee² in 1947 for making recommendations to salvage dry cattle from cities and towns. The Committee found that the basic cause for the premature wastage of good quality breeding stock was the high cost of maintenance of cattle and buffaloes in the city stables and that the only satisfactory solution was to remove them out of the urban areas. Another Committee of experts was set up in 1954 to consider *inter alia* the steps to be taken (a) to prevent killing of milch cows particularly in the cities of Calcutta and Bombay when they go temporarily dry and (b) to impose some effective control on inter-State movement of cattle. The Committee was of the view that the ultimate solution to the problem will be the wholesale removal of milch cattle from the cities and to meet the city milk requirements from rural milk production. The Committee recommended the setting up of a comprehensive organisation in each State for handling the numerous

1 Pepperall, R.A. 1946. *The dairy industry of India*. Report on an investigation with recommendations. Government of India Press, Simla.

2 Report of the Cattle Preservation and Development Committee. 1948. Ministry of Agriculture, Government of India, New Delhi.

aspects of cattle development and milk production in its rural areas. Some action was taken on these recommendations by the States during the Second and Third Plans but the programmes did not produce any perceptible impact on this problem. On the contrary, the exodus of superior milch cattle from breeding tracts continued at an accelerated rate. The CCG¹ came to the conclusion in 1961 that the problem was a colossal one and called for a detailed examination by a special high power committee. Accordingly a committee under the chairmanship of the then Member of Agriculture, Planning Commission was constituted by the CCG. The Committee examined in depth the reasons for depletion of high yielding cattle from the breeding tracts in Punjab, Uttar Pradesh, Bihar and Gujarat and gave numerous suggestions for the preservation and development of milch cattle in the cities of Calcutta and Bombay. The Committee estimated that as many as 55,000 milch animals mainly buffaloes were being maintained in private stables within Greater Bombay alone. Since then the number has increased to nearly 89,000² (1972-73). Milch animals for Bombay are mainly obtained from Punjab, Haryana and parts of Rajasthan and Gujarat.

28.14.2 Another distressing factor observed by the Committee was that against about 50,000 milch buffaloes maintained outside the milk colony in Bombay, the number of calves in those stables did not exceed 6,000. Most of the calves which accompanied their dams died due to neglect and starvation soon after their arrival in the city stables and even if they survived they were not in a fit condition to be reared for breeding and production. The position does not appear to have changed since then and the wastage of progeny of high yielding milch animals still continues. In Greater Calcutta there were about 80,000 milch animals in 1962 against 49,000 milch animals maintained in 1949-50. Milch animals for Calcutta are received mainly from Punjab, Haryana, Uttar Pradesh and Bihar. It was estimated by the Committee that about 60 per cent of the actual arrivals remained within the city and the rest in the peripheral areas. Among those retained in the city, about half of the animals found their place into commercial stables and the other half remained with the semi-commercial owners or individual householders. The Committee also estimated that about 10,000 dry animals were sent out for salvage and only about 3,000 cows were reported to have been bred within the city. The need for registering good quality milch animals in breeding areas and restricting their export in a manner that

¹ Report of the Special Committee on Preservation of High Yielding Cattle, 1962. Central Council of Gosamvardhana, New Delhi.

² Data obtained from the Office of the Dairy Development Commissioner, Maharashtra for the year 1972-73.

at least one or two calves of the exported animals are left behind was emphasised by the Committee. The urgency for taking up intensive cattle development programmes in the breeding areas was also stressed by the Committee.

28.14.3 The NDDB made a study of the problem of city milch cattle and came to the conclusion that the keeping and slaughter of milch animals in cities could not be prevented as long as keeping of cattle in the cities and sale of adulterated milk were profitable and a properly organised milk marketing system based on rural production of milk was not developed. The NDDB drafted proposals for making use of donated milk products from abroad in order to obtain a commanding share of the city milk markets in four major cities of Bombay, Calcutta, Delhi and Madras. The plan was to bring about economic pressure on the city milch cattle owners by supplying reconstituted milk to the public at a comparatively cheap price and to utilise the funds thus generated for resettling city milch animals in the rural areas and to increase organised milk production, procurement and processing. The proposals envisaged resettlement of about 1 lakh milch cattle from the four metropolitan cities. We have recently been informed that to some extent the city milch cattle owners have started feeling the economic pressure as some of them have approached the OFP authorities for assistance on construction of sheds, provision of land and marketing of milk in selected areas.

28.14.4 We observe with deep concern that the serious problem of destruction of high yielding milch animals as well as their progenies has been allowed to continue for so long. The deleterious effect of this situation on the country's milk production potential was discussed by us in our Interim Report on Milk Production. We had recommended that the IDC in consultation with the Maharashtra and West Bengal Governments should carry out an intensive survey of the present position of disposal of buffaloes when they 'go dry' in the cities of Bombay and Calcutta. We had further recommended that suitable programmes for timely artificial breeding of she-buffaloes and their purchase when they go dry for transfer to the milksheds of dairy projects should be drawn up. We would like to reiterate these recommendations for an early action. We realise that the measures suggested above will take a long time before the city milch cattle could be channelised in the rural areas. Since this matter is of a very urgent nature, we would like to suggest as an interim measure that a network of insemination centres should be set up within the cities in areas of concentration of milch animals. The programme should have a strong extension service to work in the

stables to educate the owners of city stables and assist them in early detection of heat in animals and timely insemination. Records of pregnant stocks should also be maintained. Such a procedure would in a large measure help to locate and purchase the pregnant animals in large numbers for distribution to milk producers' cooperatives supplying milk to the city milk plants. With progressive increase of milk production in the milkshed areas of the city milk schemes, the annual ingress of milch animals into cities will also get progressively reduced. Funds for establishing insemination centres and for financing the extension surveys should be provided by the IDC out of the OFP funds on a priority basis.

15 CATTLE INSURANCE

28.15.1 The Royal Commission on Agriculture referred to the tendency on the part of the farmers to keep more cattle than they could feed properly. They attributed the uncertainty of animal life as one among the many reasons for such a situation. The only insurance to cover the risk of animal loss available to the farmers was to have more animals than actually needed by them. Thus the tendency to maintain more animals of lower efficiency on limited feed resources has been allowed to continue. This proves as a hindrance to cattle development through better feeding and breeding. There are a number of instances where farmers showed reluctance to accept credit for purchase of good milch animals because of the fear of losing them even before the loan is cleared. Among the many measures that could be taken to decrease the number of inferior cattle and increase investment on high quality animals, cattle insurance merits important consideration. Removal of risk of loss on invested capital on animals would encourage farmers to go in for more efficient bullocks for work and superior female stock for breeding and milk production.

Problems of Cattle Insurance

28.15.2 The earlier attempts for promoting cattle insurance both by State Governments and insurance companies did not meet with any success. The main reasons were general ignorance, poverty and lack of initiative on the part of the average farmer to appreciate the usefulness of cattle insurance. However, efforts for promoting insurance of milch animals are now being made in some States in dairy

projects. In Gujarat almost all purebred exotic cattle are being insured. Insurance of cattle has also been introduced under the SFDA project in Surat. Under the MFAL project in Baroda a system of raising risk fund is in vogue. The risk fund is created through contribution of one per cent of the cost of the animal by the purchaser, one per cent by the financial institution and two per cent by the agency (SFDA/MFAL). In Punjab milch cattle are insured by the Cooperative General Insurance Society. Similar Schemes are also in operation on a limited scale in Andhra Pradesh.

28.15.3 In recent years under SFDA and MFAL projects efforts have been made to obtain credit facilities for the farmers to enable them to purchase good milch stock. The credit giving agencies naturally demand reasonable safeguards for covering risk of animal loss which might jeopardise the ability of the loanee to pay back the credit. We have mentioned in our Interim Report on Milk Production the importance of insurance cover both as collateral security to the financial agencies and as safeguards to the interests of the small farmers. In other words, we had tried to impress that cattle insurance should be considered as one of the many important inputs and services required for success under any cattle development and milk production programmes. It is understood that some efforts are being made by the General Insurance Corporation (GIC) to transact cattle insurance business on a limited scale in selected areas providing coverage mainly to milch stock owned by large and well-managed dairies and progressive farmers. The subsidiaries of the GIC are at present charging premium for the standard type of insurance cover on rates varying from 5 to 6½ per cent calculated on the insurance value of the animals, the actual rate depending upon the number of animals insured, the standard of management, adequacy of veterinary services, etc. For purposes of insurance the value is usually restricted to 80 per cent of the market value, the balance 20 per cent being left to the risk of the insured. However, in cases of loans obtained from banks for purchase of animals the sum insured is the same as the market value or the amount of loan actually utilised for the purchase whichever is less. As the value of the milch animals depends on the stage of lactation, it goes down as lactation advances and the insurance policies are made subject to a warranty providing for a reduction in the indemnity payable. The GIC feels that there is little scope for reduction in the premium rates presently charged and that any relaxation in the conditions without providing for alternate safeguards is bound to push up claims cost which ultimately would be reflected in high premium rates. The position is to be viewed in the light of the situation that the high rate

of premium is at present acting as a deterrent in promoting cattle insurance. GIC and its subsidiaries cannot at the same time be expected to undertake cattle insurance as promotional activity and reduce the premium rate at the risk of entailing loss to the corporation.

28.15.4 The project authorities implementing cattle development and milk production enhancement programmes should take up promotion of cattle insurance with the same priority as given to other inputs and services and create conditions conducive for the GIC to take up cattle insurance business in a big way in these areas. This means that the project should organise an efficient veterinary coverage, promote easy flow of credit, educate and enrol large number of farmers and milk producers for insurance of their stock and assist in settlement of claims etc. We recommend that the insurance agencies and the project authorities should jointly prepare pilot projects on cattle insurance in collaboration with the credit giving institutions. Such a scheme to begin with should be limited to core areas of the dairy projects and later extended to cover progressively other areas. As it would be difficult to formulate an insurance scheme for uniform application throughout the State or the country, schemes on areawise basis may be prepared.

Cattle Insurance through Cooperatives

28.15.5 In areas where the GIC would take time to initiate cattle insurance business, the cooperatives handling milk production and/or marketing or the project agencies such as ICDP, MFAL, SFDA, OFP should take up insurance business on their own. Cattle insurance could also be organised by the Milk Producers' Cooperative Unions in their respective areas of operation as an additional activity. So far as cooperatives are concerned, it appears advisable for them to formulate a workable scheme on their own for providing insurance of animals owned by their members. The cattle owners will be familiar with the working of the cooperative institutions and there would be a regular flow of inputs and services and check on the maintenance of animals by the members or the staff of the primary societies. In respect of areas where animals are purchased/raised by the members of the cooperatives, with the credit obtained from the cooperative banks, the Producer Cooperative Union may contribute, say about 1 per cent, of the insured amount as insurance coverage mainly as one of its services to encourage insurance of large number of milch animals owned by the members.

28.15.6 In case of areas covered by projects such as SFDA/MFAL, OFP, where regular cattle insurance has not been undertaken, an

alternate system of creating a 'Cattle Mortality Risk Fund' (CMRF) should be adopted. This system has been proposed by some of the SFDA/MFAL agencies to facilitate flow of credit for purchase of high quality milch animals by providing a cover for mortality among such stock. The Union Ministry of Agriculture and Irrigation (Credit Division) has agreed for the creation of CMRF at the district level under SFDA and MFAL projects either by the District Central Cooperative Bank or the lead banks of the district in consultation with the project authorities. The fund should be built up at the district level as a common fund for all the financial institutions together if there are more than one financial agencies since a wider coverage would provide a better basis for operation of this fund. The contribution may be one to two per cent from the beneficiary, two to three per cent from the SFDA/MFAL or other project agency and one per cent from the financing institution. It is also considered necessary to constitute a legal entity either in the form of a registered society or a trust to administer the fund at the district level. The above suggestion has been made only in respect of districts covered by the SFDA/MFAL projects. We recommend that similar efforts should also be made in districts covered by other cattle development and milk production projects.

28.15.7 While formulating details of the scheme of cattle insurance by the various authorities mentioned in the preceding paragraphs, it is considered necessary to make the scope of this scheme wider in respect of age groups of animals and types of insurance. The usual practice is to include animals of the ages between 3 to 8 years only. With the progressive increase in the number of crossbred animals and improved indigenous milch cattle and buffaloes, it becomes necessary to bring under cattle insurance younger animals of 1 or 2 years of age as well. The type of insurance at present contemplated is of standard type covering short period of 1 year or 18 months only. The possibility of progressively including Endowment Assurance Policy should also be considered as such facilities may be of help to cover medium term loans as well as to help large farmers and organised dairy owners who will be required to replace the stock from time to time. The insurance scheme should also cover working bullocks in the areas where cattle insurance for milch cattle is taken up.

16 EXPORT TRADE IN CATTLE AND BUFFALOES

28.16.1 In recent years, there has been an increasing interest in the purchase of cattle and buffaloes from India by countries like

Yugoslavia, Bulgaria, the Philippines, Sri Lanka, Brazil, Kenya etc. With the growing realisation of the importance of the buffalo as a producer of milk and meat, more countries may look forward for importation of superior buffaloes from India for grading up their local stocks. The possibility of demands for superior types of crossbred cattle may also be expected when a large population of uniform and genetically stable types of crossbred cows has been developed. Demands from abroad will be an important incentive for breeding better types of animals. There is, therefore, an urgent need for taking up promotional measures to build up export trade in cattle and buffaloes. Another item that can be explored for export trade is frozen semen, particularly of buffaloes. The available information on the productivity of buffaloes indicates that we have the best types of buffaloes. Experiments have already shown that buffalo semen can be deep frozen successfully. Attempts should, therefore, be made to freeze semen from superior type of buffaloes and in course of time from progeny tested buffaloes.

28.16.2 In the fifties there was a great demand from a number of countries for cattle and buffaloes of recognised Indian breeds. The foreign buying agencies indicated the need for assistance of a central organisation through which they could make their purchases as it was almost impossible on their own to identify and contact reliable sellers. They also required help in testing animals for certain diseases and for carrying out prophylactic vaccination. On the other hand, the Government of India was interested to safeguard the interests of the Indian breeders and to keep a watch that very superior animals were not sold out. Under these considerations, the Government decided that all exports of livestock should be channelised through the National Livestock Committee (NLC). This system functioned satisfactorily for some time. NLC was abolished in 1964 and its activities were merged with those of the Department of Agriculture/Directorate of Extension, Union Ministry of Agriculture and Irrigation. In our opinion, if export trade in cattle, buffaloes and other livestock is to be built up to any sizeable extent, it will be necessary to create again a separate agency like the NLC under the Ministry of Agriculture and Irrigation to which the functions of promoting export should be entrusted. As an alternative, the Government may consider entrusting this function and providing necessary funds and powers to an existing organisation like the IDC.

28.16.3 One of the main constraints that limits the scope of export of our livestock in particular to the western countries, which are otherwise interested in introducing Zebu cattle inheritance in their beef cattle, is the prevalence of diseases like rinderpest and foot-and-

mouth disease. We have discussed the question of establishment of quarantine stations on off-shore islands under paragraph 35.7.9 of Chapter 35 on Animal Health. These islands should have ship berth facilities as well as facilities for landing for small aircraft for airlifting animals, if necessary.

17 POLICIES AND PROGRAMMES FOR ACHIEVING MILK PRODUCTION TARGETS

28.17.1 All programmes for development of cows and buffaloes should lay particular emphasis on increasing their milk production capacities in order to reach the level of estimated demand of milk projected in paragraph 28.3.6, which envisages an increase in milk production from the present level of about 21.70 million tonnes to 44.17 million tonnes in 1985 and 64.40 million tonnes in 2000 AD. Milk production has thus to be doubled by 1985 and trebled by the turn of the century. In our opinion this could only be possible if a large population of the existing low producing milch stock could be replaced by crossbred cows and improved indigenous cows and buffaloes, and the milk yield of the crossbred and improved animals as well as of the local nondescript ones could be increased. Further, cattle development programmes as outlined in Sections 5-13 of this Chapter should be undertaken expeditiously.

28.17.2 The above targets regarding the numbers of improved animals as well as the milk yield could be obtained if cattle breeding and milk production enhancement programmes are implemented on the lines indicated in our Interim Report on Milk Production. We had recommended therein that to start with such a programme should be taken up in about 113 districts, each district project covering about 50,000 breedable cows and 25,000 she-buffaloes. These districts had been identified from among the districts covered by the SFDA/MFAL projects and those to be served by the OFP. We further recommend that a similar programme should also be started in the districts that will be served by the Integrated Cattle Development-cum-Milk Marketing Projects and those covered by special area programmes such as DPAP, Command Area Development etc. The cattle and buffalo development programmes proposed by us should be taken up in about 150 selected districts by 1985 and in 200 selected districts by 2000 AD. Each district project should provide for breeding coverage for about one lakh breedable cows/she-buffaloes by the year 1985 and this should be expanded to include 1.5 lakh

of animals by 2000 AD. Development of cattle and buffaloes should also be attempted by other programmes such as Key Village Scheme. We expect that coverage under such programmes would be of the order of about 30,000 cows/she-buffaloes in each district by 1985 and that it would increase to about 50,000 per district by the year 2000 AD.

28.17.3 It should be possible to set up frozen semen stations in 75 districts by 1985 to provide breeding coverage for about one lakh breedable cows and she-buffalo population in each district. This tempo should be kept up so that by 2000 AD all the 200 districts could be provided with a Frozen Semen Bank each of which should be large enough to cover 1.5 lakh breedable cow/buffalo population by 2000 AD. On an average three inseminations in respect of frozen semen and two inseminations through the use of liquid semen may be needed per conception. Doses of frozen semen that could be annually produced from a bull is around 10,000 and from a buffalo bull about 6,000. Through liquid semen programme, a bull could be used for about 2,000 inseminations and a buffalo bull for about 1,500 inseminations in a year. On the basis of these calculations, it is estimated that the programme will need about 4,275 purebred exotic/crossbred bulls and 3,000 improved buffalo bulls in 1985 and 4,800 purebred exotic bulls and 3,000 improved buffalo bulls by the year 2000 AD. If the serviceable period of bulls is taken approximately as 5 years, the annual replacement of purebred/exotic crossbred bulls would be about 1,000 and about 700 to 750 in the case of buffalo bulls. Assuming that 4 to 5 foundation cows would produce one good bull every year, about 4,000 to 5,000 purebred exotic cows would be needed. This can be taken as the upper limit because when once planned crossbreeding is undertaken progressively over large areas, there would be simultaneous reduction in the requirements of purebred bulls as later only selected crossbred bulls would be needed for *inter se* breeding in crossbred cattle, for stabilising the exotic inheritance in the crossbred population. It will be seen from Appendix 28.4 that about 2,600 purebred cows of different exotic breeds are already available. It is understood that there are a few herds of exotic cattle with private entrepreneurs and a few agricultural university farms. Efforts are also being made to establish 10 or 12 large exotic cattle breeding farms with assistance from foreign countries. When once these farms are established there should be sufficient stock of exotic cows in well managed farms which could easily take care of the annual replacement requirements of bulls for the crossbreeding programmes suggested by us in 150 districts by 1985 and 200 districts by 2000 AD. Since it would take some years to fully establish these farms

and develop large herds, there would be need for a few years to import purebred bulls as well as frozen semen from bulls of above average quality. The Animal Husbandry Division of the Union Ministry of Agriculture and Irrigation should, therefore, assess in advance the annual requirements of exotic bulls needed by the different States and arrange for sufficient foreign exchange for their importation. Attempts should also be made to obtain large quantities of frozen semen from bulls of above average quality through foreign assistance and bilateral collaboration programmes.

28.17.4 The magnitude of the cattle breeding programmes as suggested above is a massive one. This would become evident if we look at one of the inputs, say the number of inseminations to be performed. The programme envisages nearly 37.5 million annual inseminations by 1985 and 90 million annual inseminations by 2000 AD. For achieving these targets with efficiency and economically, there would be a need for lot of changes in the structure of the organisations that are expected to take care of cattle and buffalo improvement and milk marketing organisations. We are of the opinion that these two activities should function complementary to each other. The best way to ensure a harmonious development of production and marketing of milk is to entrust the task of cattle development, milk collection, processing and marketing in the shape of an integrated project to a single agency, be it, Government, cooperative or corporate. Such an approach was successfully made in the development of dairying in the cooperative sector in Kaira district in Gujarat. This approach is being progressively introduced in a number of areas in different States under the OFP where the functions have been integrated and entrusted to a single corporation. While discussing the programmes under ICDPs, we have already indicated that one of the reasons for not achieving the desired success has been the lack of proper integration with the milk marketing programmes. We, therefore, recommend that as far as possible, a single agency should be entrusted with the functions of both these activities in areas covered by the dairy projects. When such a system is adopted, the cost of breeding service as well as of other services like health care could be paid for by the beneficiaries through their milk bills. It would be well-nigh impossible for the Government exchequer to bear the burden of the cost of breeding and other services that are to be provided over extensive areas under the livestock development programmes. In our opinion Government should restrict their funding to provide breeding and other services only in respect of special and backward areas until such time remunerative marketing of milk and milk products is arranged in these areas. We have

dealt with this aspect in detail in Chapter 29 on Dairy Development.

18 SUMMARY OF RECOMMENDATIONS

28.18.1 The following is a summary of the important recommendations made in the text of this chapter.

1. Massive programmes for improving the reproductive and productive efficiency of cattle and buffaloes should be undertaken. Low producing stock should be progressively eliminated so that the limited feed and fodder resources are available for proper feeding of high producing animals.

(Paragraphs 28.2.13 & 28.2.15)

2. All the States should carry out simultaneously integrated surveys for estimation of milk and other livestock products.

(Paragraph 28.3.4)

3. The working of the Key Village Scheme should be quickly reappraised by a team of experts so that the scheme could function on sound lines. The Key Village Blocks should be developed into nucleus cattle breeding centres as originally envisaged under the scheme.

(Paragraph 28.4.12)

4. Early action should be taken to implement the suggestions made by the Indian Institute of Management, Programme Evaluation Organisation of the Planning Commission and at the Symposium on Statistical Assessment of ICDPs for improving the working of the projects. Particular emphasis should be laid on the involvement of State Agriculture Departments in fodder development programmes. Rural milk cooperative societies should be organised and periodical surveys and reviews for assessment and evaluation work in areas covered by ICDPs should be made.

(Paragraphs 28.4.15 & 28.4.16)

5. Emphasis on future cattle and buffalo development should be on increasing milk production and improving the working efficiency of bullocks through planned breeding system.

(Paragraph 28.5.15)

6. Each State Government should set up a team of animal breeding and farm management specialists to study the working of the existing cattle/buffalo breeding farms and to make comprehensive suggestions for their working on scientific and economical basis. Such of the small farms which do not offer scope for breeding programmes should either be closed down or utilised for maintaining other livestock.

(Paragraphs 28.6.2 & 28.6.4)

7. Setting up of new large farms should be avoided unless facilities and finances for their establishment within a reasonable period of time are assured.

(Paragraph 28.6.6)

8. The Central Government should identify more farms where planned progeny testing programmes can be undertaken and extend financial assistance to them. The State Governments should be discouraged from spending on smaller farms or on establishment of farms with small herds. Farms for draught breeds should be set up in areas where the draught breeds are of excellent quality.

(Paragraph 28.6.7)

9. For taking up a proper breeding programme, there should be at least 150 cows/mature heifers at each of the exotic cattle breeding farms. Wherever possible small herds should be combined to form a large herd at the most convenient farm.

(Paragraph 28.6.8)

10. The Military Farms Directorate should examine their present crossbreeding policy in consultation with the leading animal breeding specialists in the country and lay down a definite long range programme.

(Paragraph 28.7.5 to 28.7.6)

11. The Military Farms Directorate should group the crossbred stock in the military farms according to their genetic make-up and take up studies on their comparative performance and adaptability in different agro-climatic regions.

(Paragraph 28.7.6)

12. The Union Ministry of Agriculture and Irrigation and ICAR should actively collaborate with the crossbreeding programmes in the military dairy farms and extend expert advice and financial support for their breeding experiments.

(Paragraph 28.7.7)

13. The experience gained in the adoption of improved dairy management practices at the military farms should be made use of in the production of purebred exotic bulls. One of the military farms having facilities for housing and fodder production should be earmarked for developing a purebred exotic cattle breeding farm.

(Paragraph 28.7.9)

14. Superior female calves born in the military dairy farms should be reared at their youngstock farms.

(Paragraph 28.7.10)

15. The State Governments should convert some of their existing farms located in areas of surplus grass production into youngstock rearing farms so that growing heifers can be maintained economically

on grass and hay.

(Paragraph 28.7.11)

16. Facilities available with selected gaushalas should be utilised for developing sizeable herds of purebred cattle and for undertaking a crossbreeding programme for increased milk production. Government of India should provide financial assistance for creating adequate facilities for meeting operational cost on such programmes.

(Paragraph 28.8.6)

17. Gaushalas maintaining small herds but otherwise having progressive management should be assisted by the State Governments to strengthen their herds for production of milk and quality bulls.

(Paragraph 28.8.6)

18. Non-official institutions maintaining dairy herds and needing technical advice and financial support for increasing their herd size and milk production should be included in the gaushala development programme.

(Paragraph 28.8.7)

19. Breeding for milk production should be concentrated in milkshed areas that can be conveniently linked up with the existing and the proposed dairy projects.

(Paragraph 28.9.5)

20. Milk production should be on commercial and remunerative basis to attract the farmers and should be attempted through planned crossbreeding, selective breeding and grading up of indigenous cattle; selective breeding and grading up of buffaloes.

(Paragraph 28.9.5)

21. In indigenous cattle with high level of milk production, where crossbreeding with exotic breeds is not likely to be introduced, intensive selective breeding should be undertaken.

(Paragraph 28.9.8)

22. Bulls used for breeding should be of superior pedigree and preferably progeny tested.

(Paragraph 28.9.8)

23. Areas which do not offer scope for marketing of milk and where introduction of crossbreeding is difficult, farmers should be helped to replace progressively their low producing nondescript cattle by general utility type animals by grading up local stock.

(Paragraph 28.9.8)

24. Large size artificial insemination centres should be organised on district/regional basis.

(Paragraph 28.10.2)

25. Each AI centre should have a well equipped laboratory and arrangements for quick and efficient collection, examination and

storage of semen samples.

(Paragraph 28.10.2)

26. New dilutors should not be used on field scale without proper trials under controlled conditions.

(Paragraph 28.10.4)

27. Until preparation of semen extenders is taken up on commercial basis, the State Departments of Animal Husbandry should arrange for centralised manufacture of approved dilutors.

(Paragraph 28.10.4)

28. Desirability of designating one of the centralised semen laboratories in a region for manufacturing and supplying extenders to different AI centres should be explored.

(Paragraph 28.10.4)

29. Each State Department of Animal Husbandry should advocate the use of only one type of dilutor and continue the same till a better one is recommended after controlled experiments both under laboratory and field conditions.

(Paragraph 28.10.4)

30. Uniformity in procedures for semen evaluation both for routine and periodical testing should be laid down, so that it may be possible to evaluate and compare the results achieved in different States/Centres.

(Paragraph 28.10.5)

31. In order to maintain a satisfactory level of conception rate, semen from AI centres should be despatched daily or at the most on alternate days. The AI sub-centres in areas, which are not easily accessible and where semen cannot be supplied even on alternate days, should be provided with small refrigerators.

(Paragraph 28.10.6)

32. Wherever possible, transport facilities of dairy schemes should be availed of for semen transport.

(Paragraph 28.10.7)

33. For increased coverage and providing AI service economically, insemination work should be entrusted to properly trained village educated youths.

(Paragraph 28.10.8)

34. A reasonable fee for insemination services should be levied.

(Paragraph 28.10.9)

35. Special fee should be charged for providing the AI services at the door of the farmers.

(Paragraph 28.10.10)

36. The Animal Husbandry Division of the Union Ministry of Agriculture and Irrigation should investigate the causes for poor

response to AI and suggest measures for increasing breeding coverage by the AI centres.

(Paragraphs 28.10.11 & 28.10.12)

37. Adequate number of bulls of superior quality preferably proven sires should be maintained at each AI centre to ensure regular despatch of high quality semen.

(Paragraph 28.10.12)

38. Insemination services should be ensured from morning till evening on all the days of the week.

(Paragraph 28.10.12)

39. Areas where AI is to be introduced should be adequately served by dairy extension work.

(Paragraph 28.10.13)

40. Laying of minimum targets of work would be advantageous in areas where AI is introduced for the first time and in areas where AI work continues to be poor. Incentives should be provided for those who show evidence of special interest.

(Paragraph 28.10.14)

41. A uniform method of recording inseminations, estimation of results and calculation of conception rate should be evolved by the Animal Husbandry Division of the Union Ministry of Agriculture and Irrigation in consultation with the States for adoption.

(Paragraph 28.10.15)

42. The officers-in-charge of AI centres should have thorough practical and theoretical training in AI and physiopathology of reproduction. A minimum training course of three months in these subjects is considered essential.

(Paragraph 28.10.17)

43. For ensuring sufficient practical knowledge for stock assistants and field inseminators, the training course should be at least for three months.

(Paragraph 28.10.17)

44. Introduction of frozen semen technique in AI should be planned carefully. Each State Government should depute three or four experienced AI officers for practical training in the organisation and management of a frozen semen station and in the field use of this technique. These officers after training should be entrusted with the responsibility of developing Frozen Semen Stations in their respective States as training centres. As far as possible standard procedures and equipment should be practised in freezing and using the frozen semen.

(Paragraph 28.10.19)

45. The experience of the Indo-Swiss Project should be gainfully utilised for planning crossbreeding programmes with clearcut

objectives.

(Paragraph 28.11.4)

46. In all the cattle and dairy development projects, a clearcut breeding policy should be laid down in advance about the exotic breeds to be used, level of exotic inheritance to be reached, the type of crossbred bulls to be used for *inter se* mating etc.

(Paragraph 28.11.8)

47. Bulk of exotic inheritance should be obtained through Jersey breed. When efficient animal health coverage and adequate supply of feeds and fodder can be ensured Holstein-Friesian breed should also be used along with Jersey.

(Paragraph 28.11.9)

48. In hilly regions of the North-Eastern States where beef consumption is popular, heavier exotic breeds like Brown Swiss and Red Dane should be used for crossbreeding, provided grassland development and fodder production could be augmented in those areas.

(Paragraph 28.11.10)

49. Crossbreeding policy should broadly aim at producing crossbred stock with 50 to 75 per cent exotic inheritance.

(Paragraph 28.11.11)

50. Under the Fifth Plan there is a proposal to set up 10 to 12 large exotic cattle breeding farms. These should be established in the States where there are no large exotic herds and where progressively more and more areas are to be brought under crossbreeding programmes.

(Paragraph 28.11.13)

51. Each crossbreeding project should ensure that the exotic inheritance in the crossbreeds is stabilised and maintained at the desired level.

(Paragraph 28.11.14)

52. If policy in a State is to use crossbred bulls having exotic inheritance from a particular exotic breed and an indigenous breed, the State should have a planned breeding programme implemented in one of their large farms for producing crossbred foundation stock with the required level and type of exotic and indigenous inheritance.

(Paragraph 28.11.14)

53. A Panel of Animal Geneticists should define the mechanics of undertaking a systematic progeny testing of bulls used in the crossbreeding areas.

(Paragraph 28.11.15)

54. Incentives should be given to encourage importation of dairy cattle through individuals of Indian origin who have settled abroad. Government of India may provide foreign exchange to meet the

cost of transport of animals from abroad which can be recovered on 'rupee payment' basis from the recipients. Coordination of work relating to collection of animals in foreign countries, their transportation and distribution to their respective recipients in India after inspection, quarantine and prophylactic vaccination may also be undertaken by Government.

(Paragraph 28.11.16)

55. A fresh review and a study in greater depth should be made for a more satisfactory breed classification of the Indian buffalo stock.

(Paragraph 28.12.4)

56. The buffalo should be developed not only for enhancement of milk production but also for making it a source of production of quality meat.

(Paragraph 28.12.5)

57. Major emphasis should be laid for improvement of only the Murrah and Surti breed of buffaloes.

(Paragraph 28.12.6)

58. Under the prevailing conditions attempts need not be made to develop distinctly separate milk and meat breeds or types of buffaloes.

(Paragraph 28.12.6)

59. Both official and unofficial organisations interested in dairy development should put in all possible efforts to achieve a high national level of buffalo milk production with time bound programmes.

(Paragraph 28.12.16)

60. Considerably greater attention than what has been given so far should be directed to the buffalo for milk production enhancement without delay.

(Paragraph 28.12.17)

61. Wherever possible, studies on reproduction of the female buffalo should include study on animal behaviour during oestrus. This should be done with the particular objective of developing husbandry for accurate and early detection of oestrus.

(Paragraph 28.12.18)

62. Agricultural universities should draw up short term and long term research programmes for studying reproduction and production physiology of the buffalo. Coordinated research programmes should be undertaken when such a procedure is expected to yield the best results.

(Paragraph 28.12.19)

63. The Central and State Governments should critically reexamine the position of progeny testing programmes in buffaloes with a view to identifying the constraints that are impeding early imple-

mentation of the programmes and for taking remedial measures.

(Paragraph 28.12.28)

64. Seed stock buffalo farms should be created in the States with large buffalo population and in the Central Sector. Military dairy farms with good buffalo stock offer good prospects for establishment of such farms.

(Paragraph 28.12.28)

65. A number of seed stock farms with at least 150 breeding she-buffaloes should be established.

(Paragraphs 28.12.29 & 28.12.30)

66. In buffalo farms and research institutes wide scale investigations and studies should be undertaken on early weaning of buffalo calves and their rearing on low cost calf starters.

(Paragraph 28.12.37)

67. Research studies on the effect of feeding and husbandry on fattening of buffalo calves should be undertaken. Promotional activity for consumption of buffalo meat in the country and consumer educational programme should be undertaken on a countrywide scale.

(Paragraph 28.12.37)

68. A deliberate and energetic drive should be made to develop export trade in buffalo meat.

(Paragraphs 28.12.34 to 28.12.37)

69. A Committee of Experts should study the position and suggest measures to improve the milk recording system.

(Paragraph 28.13.4)

70. For proper coordination and for avoiding duplication of efforts, milk recording scheme should be administered by a single agency.

(Paragraph 28.13.6)

71. Institutions and individual farmers owning five animals or more should be organised on the lines of dairy herd improvement associations in the West. The animals should be recorded by the project authorities according to the approved system on payment of a nominal fee by the owners.

(Paragraph 28.13.7)

72. Farmers should be organised into herd improvement associations for implementation of milk recording programmes. Registration of eligible animals in herd books should be progressively introduced.

(Paragraph 28.13.7)

73. A procedure for registration of all imported purebred cattle and their progeny should be evolved and their herd books should be maintained by the Central Herd Book Organisation (CHBO).

(Paragraph 28.13.9)

74. Maintenance of herd books for cattle breeds like Sahiwal, Sindhi and Tharparkar and Murrah breed of buffaloes which are used in many States should be the responsibility of the Central Organisation.

(Paragraph 28.13.9)

75. Registration and maintenance of herd books in respect of breeds whose breeding tracts are confined to a single State should be the responsibility of the concerned State.

(Paragraph 28.13.9)

76. To ensure adoption of uniform procedures of inspection, recording and registration, the CHBO may act as the coordinating agency.

(Paragraph 28.13.9)

77. The CHBO should lay down procedures for milk recording and registration of crossbred cattle.

(Paragraph 28.13.10)

78. The CHBO in the Animal Husbandry Division of the Union Ministry of Agriculture and Irrigation should be suitably strengthened and headed by a wholetime Registrar. Herd book and milk recording cells should be organised under the State Animal Husbandry Departments.

(Paragraph 28.13.11)

79. The Indian Dairy Corporation (IDC) in consultation with the Maharashtra and West Bengal Governments should carry out an intensive survey of the present position regarding disposal of cattle and buffaloes, when they go dry in cities of Bombay and Calcutta. Suitable programmes for timely artificial breeding of she-buffaloes and their purchase, when they go dry should be drawn up. As an interim measure, a network of AI centres should be set up within the cities and funds for establishment of centres and financing extension surveys should be provided by the IDC.

(Paragraph 28.14.4)

80. The insurance agencies and the project authorities should jointly prepare pilot projects on cattle insurance in collaboration with the credit giving institutions on areawise basis.

(Paragraph 28.15.4)

81. In areas where the General Insurance Corporation would take time in initiating cattle insurance, the cooperatives handling milk production and/or marketing or the project agencies should take up this activity.

(Paragraph 28.15.5)

82. Areas covered by projects such as SFDA/MFAL, OFP, where regular cattle insurance has not been undertaken, an alternate system

of creating a Cattle Mortality Risk Fund should be adopted. Similar efforts should also be made in districts covered by other cattle development and milk production projects.

(Paragraph 28.15.6)

83. The insurance scheme should also cover working bullocks in the areas where cattle insurance for milch cattle is taken up.

(Paragraph 28.15.7)

84. There is an urgent need for taking up promotional measures to build up export trade in cattle and buffaloes.

(Paragraph 28.16.1)

85. Possibility of exporting frozen semen from superior buffalo bulls should be explored.

(Paragraph 28.16.1)

86. A separate agency under the Union Ministry of Agriculture and Irrigation should be created for promoting export trade in cattle, buffaloes and other livestock. Alternatively, the Government of India may consider entrusting this function to an organisation like the IDC.

(Paragraph 28.16.2)

87. Milk production enhancement programmes as recommended for SFDA/MFAL projects should also be started in districts to be covered by the Integrated Cattle Development-cum-Milk Marketing Projects and Special Area Programmes. The proposed cattle and buffalo development programmes should be taken up in about 150 selected districts by 1985 and in 200 selected districts by 2000 AD.

(Paragraph 28.17.2)

88. The Animal Husbandry Division of the Union Ministry of Agriculture and Irrigation should assess annual requirements of exotic bulls and arrange for foreign exchange for their importation. Possibilities of importing large quantities of frozen semen from bulls of above average quality through foreign assistance and bilateral collaboration programmes should be explored.

(Paragraph 28.17.3)

89. The task of cattle development, milk collection, processing and marketing in the shape of an integrated project should be entrusted to a single agency, preferably a cooperative of the producers.

(Paragraph 28.17.4)

APPENDIX 28.1

(Paragraph 28.2.2)

Cattle and Buffalo Population in Undivided India a, 1, 2, 3
1919-20 to 1944-45

Category	1919-20	1924-25	1929-30	1934-35	1939-40	1944-45
cattle :						
bulls	5,100	4,672	3,980	48,870	46,856	47,319
buffaloes	41,642	43,886	45,372			
	46,742	48,558	49,352			
cows	35,863	36,434	37,295	37,255	36,445	35,140
youngstock (calves)	30,138	30,299	31,119	34,463	32,216	28,998
total cattle	112,743	115,291	117,766	120,588	115,517	111,457
buffaloes :						
male	5,091	5,054	5,224	5,473	4,911	4,979
female	12,968	13,796	14,376	15,039	15,131	15,646
youngstock (calves)	9,385	10,570	11,001	12,645	12,053	11,395
total buffaloes	27,444	29,420	30,601	33,157	32,095	32,020
grand total (cattle & buffaloes)	140,187	144,711	148,367*	153,745**	147,612@	143,477

*Exclusive of the two Agency districts of the N.W. Frontier Province.

**Includes 1929-30 census figures for Bengal, Bihar and Orissa where no census was taken in 1934-35, but excludes those for the two Agency districts of the N.W. Frontier Province.

@Includes 1935-36 census figures for Orissa and 1934-35 census figures for U.P. where no census was taken in 1939-40 but excludes those for the two Agency districts of N.W.F.P.

- a. Relates to territories now constituted as Indian Union, Pakistan and Bangla Desh
1. Indian Agricultural Statistics, Vol. I (Provinces) 1939-40 to 1942-43 (page Nos. 2 & 3).
2. Agricultural Statistics of India, Vol. I—1919-20 (page 8).
3. Indian Agricultural Statistics 1943-47, Vol. I (page 2).

others	..	..	..	1,052	929	(-)11.7	947	..	(+)1.9
total	49,873	49,903	(+)10.06	54,204	54,720(b)	(+)10.9	56,773	(+)13.8	(+)13.7
youngstock :									
males below 1 year	9,556	10,528		10,850	11,150				
between 1—3 years	12,102	11,232		11,808	12,105				
females below 1 yr.	9,122	10,270		10,801	11,149				
between 1—3 yrs.	12,378	11,776		13,133	13,583				
youngstock total	43,578(c)	43,306	(-)0.62	48,825	48,077	(-)1.5	47,467	(+)8.9	(-)1.3
total cattle	155,239	158,669	(+)2.20	175,557	176,182	(+)10.6	178,865	(+)15.2	(+)1.5
buffaloes									
males over 3 years									
breeding	306	330	(+)7.8	291	330	(+)11.8	247	(-)19.3	(-)25.1
(in 1951 & 1956)	6,028	5,953	(-)1.2	6,645	6,972	(-)6.37	6,999	(+)16.1	(+)0.4
working	(not enunciated separately)			493	620	(+)6.6	638	..	(+)2.9
working and breeding									
both									
bulls and bullocks									
over 3 yrs. not in use									
for breeding/work	465	223	(not enunciated separately)	254	269	(+)6.0	232	..	(-)13.7
others	(not enunciated separately)				8,202(e)	(+)6.7	8,116	(+)16.2	(-)1.0
total	6,798	6,506	(-)4.28	7,684	(+)18.1				
emales over 3 years									
in milk	10,217	11,819	(+)15.67	12,463	12,924	(+)3.7	15,224	(+)32.9	(+)17.8
dry	10,787	9,868	(-)8.5	9,496	10,440	(+)9.9	11,400	(+)26.9	(+)9.2
not calved even once	(included in above)			2,279	2,151	(-)5.6	2,287	(+)6.3	(+)6.3
used for work	550	420		487	386	(-)20.8	381	(-)30.7	(-)1.3
others (for 1951 & 1956—not used for breeding/work)	297	245		297	244	(-)18.0	261	(-)12.1	(+)7.0
total	21,850	22,352	(+)2.29	25,023	26,160(f)	(+)11.9	29,553	(+)35.2	(+)13.0

APPENDIX 28.2 (Contd.)

1	2	3	4	5	6	7	8	9	10	11
youngstock :	1951	1956	1961	1966		1972				
male below 1 yr.	2,863	3,551	4,037	3,966						
between 1—3 yrs.	2,380	2,013	2,479	2,437						
female below 1 yr.	4,172	5,237	5,803	5,893						
between 1—3 yrs.	5,262	5,287	6,029	6,286						
total	14,753	16,088	(+) 19,000	18,504	(+) 15.01	18,593	(+) 10.4	20,272	(+) 37.5	(+) 9.1
total buffaloes	43,401	44,916(g)	(+) 3,59	51,210	(+) 14.01	52,955	(+) 3.3	57,941	(+) 33.5	(+) 19.5

(a) Includes 56,000 for which details are not available.

(b) Includes 37,000 for which details are not available.

(c) Includes 4,19,949 for which male/female break-up is not available.

(d) Figures for 1951 and 1956 are for 'dry and not calved' category.

(e) Includes 11,000 for which details are not available.

(f) Includes 15,000 for which details are not available.

(g) Includes 1,760 for which details are not available.

1 Indian Livestock Censuses 1956, 1961, 1966 and 1972.

Note : Differences in totals are due to inclusion of certain States data for which details are not available.

APPENDIX 28.2A
Average Annual Employment of Bullocks¹ (Paragraph 28.2.8)


WEST BENGAL			ORISSA		UTTAR PRADESH		MADHYA PRADESH		PUNJAB	
Holding size group (acres)	Per-centage utilised	Holding size group (acres)	Per-centage utilised	Holding size group (acres)	Bullock labour days	Holding size group (acres)	Hours of employ-ment	Holding size group (acres)	Work days (8 hours per day)	
1	2	3	4	5	6	7	8	9	10	
.01—1.25	10.9	0.01—2.50	9.78	Below 2.5	39	0—5	389.5	0.5	72	
1.26—2.50	15.2	2.51—5.00	16.18	2.5—5.0	82	5—10	530.8	5—10	103	
2.51—3.75	13.9	5.01—10.00	18.20	5.0—7.5	131	10—15	740.5	10—20	130	
3.76—5.00	18.1	10.01—15.00	16.04	7.5—10.0	152	15—20	536.5	20—50	157	
5.01—7.50	18.6	above—15.00	20.30	10.0—15.0	188	20—30	598.1	50 and above	195	
7.51—10.00	16.7	average	16.95	15.0—20.0	247	30—40	655.9	average	136	
10.01—15.00	16.9			20.0—25.0	294	40—50	702.2			
above 15.00	20.0			25 & above	411	50 & above	796.6		(37.3%)	
average	15.9			average	164	average	666.5			

¹ Studies in Economics of Farm Management, Directorate of Economics and Statistics.

APPENDIX 28.3

(Paragraph 28.2.15)

Cattle and Buffalo Population—1951 to 2000 AD

		Population according to Livestock Censuses						Projections			(million)
		1951	1956	1961	1966	1972	1980	1985	2000		
1	2	3	4	5	6	7	8	9			
											
सत्यमेव जयते											
<i>cattle</i>											
<i>males</i>											
breeding	0.65	0.44	0.36	0.43	0.42	0.41	0.40	0.28			
working	58.47	62.48	70.67	71.43	72.76	74.32	74.32	72.76			
others	2.68	1.96	1.50	1.47	1.44	1.39	1.25	0.34			
<i>females</i>											
breeding	46.37	47.26	51.50	51.77	53.72	55.40	55.40	51.25			
working	2.31	1.83	2.15	1.98	2.10	2.10	1.89	0.47			
others	1.19	0.81	1.05	0.93	0.95	0.88	0.79	0.20			
youngstock	43.58	43.31	48.82	48.08	47.47	46.52	45.94	42.49			
total :	155.24	158.67	175.56	176.18	178.86	181.02	179.99	167.79			
<i>buffaloes</i>											
<i>males</i>											
breeding	0.31	0.33	0.29	0.33	0.25	0.22	0.20	0.14			
working	6.03	5.95	7.14	7.59	7.64	8.05	8.05	6.84			
others	0.47	0.22	0.25	0.27	0.23	0.22	0.20	0.05			

females												
breeding	.	.	.	.	21.00	21.69	24.24	25.51	28.91	33.07	33.07	30.59
working	.	.	.	.	0.55	0.42	0.49	0.39	0.38	0.32	0.29	0.07
others	.	.	.	.	0.30	0.25	0.30	0.24	0.26	0.23	0.21	0.05
youngstock	.	.	.	.	14.75	16.09	18.50	18.59	20.27	21.70	21.70	19.07
total :	.	.	.	.	43.40	44.82	51.21	52.96	57.94	63.81	63.72	56.81



APPENDIX 28.4

(Paragraph 28.6.8)

Location, Breed and Size of Exotic Herds

State	Location	Breed	Herd-size
Andhra Pradesh	Mannoor	J	50
	A.P.D.C., Hyderabad	J	13
	I.D.C., Hyderabad	F	12
Assam	Barpeta	J ¹	150
	Khanapara	J	50
Bihar	Patna	HF	25
	Hotwar	J	25
	Gaurikarma	J	50
	B.S.D.C., Patna	J	15
Gujarat	Anand	J	80
	Bidaj	J	60
Haryana	Hissar	J	75
		HF ¹	150
	Bhivani	J	25
Himachal Pradesh	Palampur	J ²	250
	Bhagthan	J	10
	Kotnipura	J	15
	Kamand	J	60
Jammu & Kashmir	Belicharna	J	10
	Cheshmashahi	J	50
Karnataka	Hessarghatta	HF	50
		RD ³	150
	Munirabad	RD ³	30
	Kudigi	J ³	30
Kerala	Dharwar	J ³	30
	Mattupatti	BS ⁴	50
		BSX	250
	Peermedu	J	50
Madhya Pradesh	Bilaspur	J	25
Maharashtra	Tathewade	J	75
	Baif	J	100
	Urli Kanchan	HF	150
Manipur	—	—	—
Meghalaya	Shillong	J ³	50
		HF	50
Nagaland	—	—	—
Orissa	—	—	—
Punjab	Patiala	BS ⁴	125
	Nabha	BSS	
	Mattewara	HF	125
	Rupar	J	50
	P.D.C.C.	J	14
	Bhatian	HF	16

APPENDIX 28.5

(Paragraph 28.10.3)

Questionnaire asking for Information on Artificial Insemination Services
(Organisational set-up, techniques, supplies and services, training of
personnel etc.) in the States.

Name of the State : _____

General

1. When was artificial insemination technique first introduced in your State ?
2. What are the various schemes of cattle development under which artificial insemination service forms an integral part of the breeding programme ?
3. What are the different sizes of AI stations in the States (2-bull, 4-bull etc.) ?

Semen Extenders

4. What is the periodicity of collection generally adopted in respect of bulls and buffalo bulls at the centres ?
5. What are the various types of dilutors used for extending zebu/exotic and buffalo bull semen ? Mention antibiotic agents used and also brand and doses. Give reasons for different types of dilutors being used at different stations.
6. Do you recommend centralised preparation of dilutors for district/regional/State basis ?
7. Do you recommend one common type of dilutors for all centres in the States ?
8. What is the usual dilution rate practised for extending zebu, exotic and buffalo bulls ?

Transport of Semen

9. How often semen is despatched from the Collection Centres to the AI Units/Sub-centres ?
10. What are the arrangements made for keeping semen at low temperature at Sub-centres ? Are there small refrigerators at each Sub-centre ? How often ice is despatched to the Sub-centres, to replace ice in the flasks/containers with diluted semen ?
11. What are the different methods/modes of transport of semen largely used at these centres ? Have you any suggestions to improve semen transportation and also to economise on costs ?
12. What are the different types of containers used for transport of semen and the source from which they are obtained ?
13. Suggestions have been made that with a view to facilitate quick and more frequent transportation of semen to a large number of insemination centres in the rural areas, advantage could be taken of the milk collection vans of dairy schemes. What are your views on this procedure ?
14. What is method of insemination (Rectrovaginal or Speculam) adopted by the different levels of personnel ?

Technique and Evaluation of Insemination

15. What are the various criteria and methods used in evaluating semen quality at these Centres ?
16. What are the various records maintained at these centres ?
17. What are the methods/basis adopted for evaluating the breeding efficiency at each of these centres ? (e.g. percentage conception,

Number of inseminations per conception, non-return basis, actual calves born/rectal palpation etc.)

18. Are figures relating to insemination given separately for first insemination and the repeat inseminations?
19. Are evaluations of percentage of fertility obtained made from every year? If so what are the results obtained in different centres?

Training of Personnel

20. What are the training facilities available for giving special training in AI technique etc. for the different levels of personnel, such as veterinary graduates, stock assistants, lay inseminators and others?
21. What is the type and duration of the training given to different levels of personnel such as veterinary graduates, stock assistants, lay inseminators and others?
22. What are the technical organisations at the District, Divisional and State level for periodical inspection, evaluation and guidance of artificial insemination work in the different centres in the States?
23. Do you recommend centralised semen collection on district/regional basis? Please give reasons.
24. Do you advocate training of lay-inseminators and educated young farmers from the villages for expanded coverage of breeding in the State?

Field Use

25. Do you recommend artificial insemination service on a custom basis through private practitioners, trained lay-inseminators and others in rural areas?
26. Do you recommend charging fee for artificial insemination service? Give reasons.
27. Do you recommend a uniform system of recording of data, publication of information on artificial insemination services etc. in the State and in the country as a whole?

Suggestions for Improvement

28. What are your suggestions for improving the breeding coverage and efficiency through artificial insemination?
29. What are the measures taken to prevent possibilities of fictitious entries relating to inseminations by the staff?
30. Have you fixed any targets of work for each Artificial Insemination Station/Insemination Unit/Sub-centres?
31. There is a view that the results of artificial insemination in a number of centres leave much to be desired. If you subscribe to this opinion, please give your reasons for this alleged unsatisfactory status. Have you any suggestion to offer to improve the efficiency of work in all aspects and also to ensure that AI data are maintained in an accurate manner?

Use of Frozen Semen

32. To what extent the use of frozen semen has been introduced in your State? What are the results obtained so far?
33. What is the scope for introduction of frozen semen technique on an expanded basis in your State?

Place :

Name : _____

Date :

Designation : _____

APPENDIX 28.6

(Paragraph 28.10.11)

Number of Artificial Insemination Centres, Bulls Maintained and the Inseminations performed (as on 1-4-1973)

State/Union Territory	Number of AI centres/ sub-centres	Number of bulls for AI	Total AIs done	Average of number of inseminations	
				Insemination per bull	Insemination per Unit
1	2	3	4	5	6
Andhra Pradesh	1,421	326	216,941	665	153
Assam	308	131	15,279	180	117
Bihar	1,016	301	385,135	1,280	379
Gujarat	801	257	157,498	613	197
Haryana	475	162	90,355	558	190
Himachal Pradesh	120	30	8,191	273	68
Jammu & Kashmir	..	Not received	..	..	..
Karnataka	676	138	201,426	1,459	298
Kerala	443	212	194,222	916	438
Madhya Pradesh	816	180	86,857	483	106
Maharashtra	1,351	306	163,269	533	121
Manipur	..	Not received	..	..	..
Meghalaya	..	Not received	..	..	..
Nagaland	18	14	963	69	53
Orissa	791	183	165,842	906	210
Punjab	511	196	202,177	1,031	396
Rajasthan	246	104	38,338	369	156
Tamil Nadu	1,043	713	715,642	1,004	686
Tripura	67	31	23,621	762	352
Uttar Pradesh	2,220	1,503	1,055,801	702	482
West Bengal	551	122	160,801	1,318	292
Arunachal Pradesh	..	Not received	..	..	..
Andaman & Nicobar Islands	17	3	698	233	41
Delhi	23	17	2,983	175	130
Goa, Daman & Diu	..	Not received	..	..	..
Mizoram	1	4	..	Not furnished	..
Pondicherry	26	8	1,793	224	69
Chandigarh	4	4	3,579	895	895
Lakshadweep and Dadra & Nagar Haveli	AI work not yet started.				
total :	12,945	4,945	3,891,411	787*	301**

*, **Averages.

APPENDIX 28.7

(Paragraph 28.12.7)

World Distribution of Buffaloes and their Contribution to Milk Production¹

Name of the country	Number of buffaloes (thousand)	(thousand tonnes)		
		Milk production		
		Cows	Buffalo	Percentage of buffalo milk to total milk production
1	2	3	4	5
India	54,500	9,550	11,240	54.3
China	29,400	3,200	(total)	..
Pakistan	12,100	6,100	6,800	52.7
Thailand	6,950	3	4	57.1
Philippines	4,500	17	118	51.4
Nepal	3,480	190	370	56.0
Indonesia	2,700	35	..	..
Egypt	2,100	570	990	63.5
Turkey	1,117	2,650	290	9.9
Burma	1,600	321	29	8.2
Laos	940	29	..	..
Khamer Republic	910	17	..	..
Ceylon	720	128	38	22.9
Vietnam	565	..	..	..
USSR	460	82,100	..	..
Bangla Desh	387	..	..	..
Iraq	290	216	24	10.0
Iran	280	925	48	4.9
Malaysia (Western)	223	24	7	22.6
Taiwan	200	15	..	..
Portuguese Timor	124	..	..	..
Brazil	120	770	..	..
Malaysia (Sabah)	78	..	..	..
Rumania	75	3,500	360	0.93
Italy	55	10,397	36	0.35
Bulgaria	74	1,210	28	2.3
Yugoslavia	54	2,620	10	0.38
Afghanistan	35	311	4	1.3
Greece	18	560	7	1.2
Brunei	18	..	..	..
Malaysia (Sawasak)	8	..	..	..
Trinidad and Tobago	7	23	..	..
Albania	4	..	..	..
Singapore	3	..	..	..
Syrian Arab Republic	2	..	..	..
Hong Kong	1	..	..	..
Hungary	1	..	..	..

¹ 1971 Animal Health Year Book.

APPENDIX 28.8

(Paragraph 28.12.9)

Cattle and Buffalo Population in Andhra Pradesh, Gujarat, Haryana, Punjab and All-India—1972

Category	Population (thousand)					Percentage to total bovine population					
	All-India	Andhra Pradesh	Gujarat	Haryana	Punjab	All-India	Andhra Pradesh	Gujarat	Haryana	Punjab	
1	2	3	4	5	6	7	8	9	10	11	
cattle											
males over 3 years											
breeding	420	40	6	6	4	0.2	0.2	0.1	0.1	0.1	
breeding and work both	2,107	283	19	3	11	0.9	1.4	0.2	0.1	0.1	
working	70,656	4,964	3,022	931	1,477	29.8	25.4	30.4	18.7	19.2	
others	1,442	204	18	9	15	0.6	1.0	0.2	0.2	0.2	
total	74,625	5,491	3,065	949	1,507	31.5	28.1	30.9	19.1	19.6	
females over 3 years											
breeding	53,725	3,872	1,797	711	967	22.7	19.8	18.1	14.3	12.6	
working	2,101	240	5	11	4	0.9	1.2	0.1	0.2	0.1	
others	947	119	10	4	8	0.4	0.6	0.1	0.1	0.1	
total	56,773	4,231	1,812	726	979	24.0	21.6	18.3	14.6	12.8	
youngstock	47,467	2,785	1,580	777	1,120	20.0	14.2	15.9	15.6	14.6	
total cattle	1,78,865	12,507	6,457	2,452	3,606	75.5	63.9	65.1	49.3	47.0	
buffaloes											
males over 3 years											
breeding	247	19	8	5	7	0.1	0.1	0.1	0.1	0.1	
breeding and working both	638	92	2	7	39	0.3	0.5	0.0	0.2	0.5	

APPENDIX 28.8 (Contd.)

1	2	3	4	5	6	7	8	9	10	11
working	6,999	1,165	29	49	223	2.9	6.0	0.3	1.0	2.9
others	232	65	4	1	2	0.1	0.3	0.0	..	..
total	8,116	1,341	43	62	271	3.4	6.9	0.4	1.3	3.5
females over 3 years										
breeding	28,911	3,416	2,040	1,273	2,054	12.2	17.5	20.6	25.6	26.8
working	381	48	3	3	29	0.2	0.2	0.0	0.1	0.4
others	261	37	4	7	10	0.1	0.2	0.0	0.1	0.1
total	29,553	3,501	2,047	1,283	2,093	12.5	17.9	20.6	25.8	27.3
youngstock	20,272	2,215	1,378	1,173	1,703	8.6	11.3	13.9	23.6	22.2
total buffaloes	57,941	7,057	3,468	2,518	4,067	24.5	36.1	34.9	50.7	53.0
total bovine population	236,806	19,564	9,925	4,970	7,673	100.0	100.0	100.0	100.0	100.0

APPENDIX 28.9

(Paragraph 28.12.10)

Over Three Years Female Stock and Total Population of Cattle and Buffaloes

State/Union Territory	1961						1966						1972			
	Total cattle	Females over 3 years	Total buffaloes	Females over 3 years	Total cattle	Females over 3 years	Total buffaloes	Females over 3 years	Total cattle	Females over 3 years	Total buffaloes	Females over 3 years	Total cattle	Females over 3 years	Total buffaloes	Females over 3 years
1	2	3	4	5	6	7	8	9	10	11	12	13				
Andhra Pradesh	12,345	4,076	6,949	3,151	12,342	4,154	6,791	3,219	12,507	4,231	7,057	3,501				
Assam	6,488	1,997	583	211	6,105	1,852	541	180	5,717	1,978	638	238				
Bihar	16,104	4,352	3,698	1,650	15,157	4,105	3,654	1,663	14,911	4,186	3,679	1,903				
Gujarat	6,557	1,838	2,917	1,702	6,544	1,780	3,140	1,820	6,457	1,812	3,468	2,047				
Haryana	..	..	..	..	2,227	615	1,935	1,011	2,452	726	2,518	1,283				
Himachal Pradesh	1,213	412	208	149	1,891	615	416	272	2,176	674	544	362				
Jammu & Kashmir	1,841	645	401	221	1,791	654	428	247	2,057	766	493	286				
Karnataka	9,673	3,513	3,026	1,682	9,686	3,573	2,946	1,707	10,134	3,789	3,289	1,849				
Kerala	2,753	1,162	485	135	2,857	1,219	471	135	2,856	1,300	472	156				
Madhya Pradesh	24,774	7,374	5,576	2,317	24,644	7,359	5,607	2,343	26,461	8,121	5,795	2,543				
Maharashtra	15,328	4,644	3,087	1,639	14,729	4,534	3,042	1,735	14,705	4,587	3,301	1,871				
Manipur	293	98	55	23	288	88	48	16	294	95	52	21				
Meghalaya	N.A.	..	..	..	415	156	38	12	468	173	46	20				
Nagaland	..	..	..	..	76	29	4	1	93	39	10	4				
Orissa	9,810	3,039	1,075	306	10,628	3,419	1,269	392	11,496	4,042	1,399	441				
Punjab	6,059	1,718	4,425	2,341	3,162	829	2,983	1,514	3,606	979	4,067	2,093				
Rajasthan	13,136	4,931	4,019	2,097	13,124	4,800	4,222	2,144	12,470	4,612	4,592	2,492				
Tamil Nadu	10,826	3,653	2,594	1,290	10,859	3,711	2,724	1,346	10,775	3,745	2,879	1,502				

APPENDIX 28.9 (Contd.)

1	2	3	4	5	6	7	8	9	10	11	12	13
Tripura	.	495	148	43	16	588	181	50	525	171	20	8
Uttar Pradesh	.	26,284	6,722	10,976	5,758	26,120	6,751	11,426	5,991	26,145	6,751	6,611
West Bengal	.	11,476	3,852	986	273	12,576	4,173	1,043	293	12,188	3,869	209
Andaman Nicobar Islands	.	7	3	8	2	10	3	8	2	19	6	3
Chandigarh	.	Included	in Punjab									
Dadra & Nagar Haveli	.	N.A.				8	2	16	10	5	2	8
Delhi	.	94	30	100	59	38	12	4	1	40	13	1
Goa, Daman & Diu	.					76	24	103	64	68	24	76
Lakshadweep	.	1				125	37	35	15	124	35	17
Mizoram	.	N.A.				1	1			1	1	
Pondicherry	.	N.A.				43	17	1	1	25	11	1
all-India	.	175,557	54,204	51,210	25,023	176,182	54,683	52,955	26,160	178,865	56,773	29,553

(a)

(a) Includes 15,000 for which details are not available.

DAIRY DEVELOPMENT

I INTRODUCTION

29.1.1 The value of milk and milk products for physical development and well-being of people is now universally recognised. From time immemorial, in the dietary of Indian people, milk and milk products have been accepted as items of choice. In ancient days the population was small and life was simple and confined almost exclusively in rural areas. Cows were maintained in many homes in self-sufficient villages; there was no dearth of milk. The liking that people had developed for milk and its products continues and these items of food are equally acceptable to all communities in the country. Fluid milk and its products were generally not saleable commodities and there was no long distance movements of these products from one place to another.

29.1.2 With growth of population and change in pattern of life with urbanisation, there was rapid increase in demand for milk and its products particularly in urban areas where these items could not be and were not produced in any large quantity. And at the same time the increasing pressure on land, fragmentation of land holdings and decrease in pasture made it difficult for rural milk production to keep up with the demands in the growing towns and cities. As a result, there was an upsetting in the ancient system of production and consumption of milk and milk products and there developed an imbalance between production in the villages and supply to fast growing demand centres in congested urban areas. Due to lack of attention to organise a system of dairying based on commercial rural milk production, bulk collection, transportation, processing and supply of milk and milk products as required for the altered situation, it became increasingly difficult to meet the demands in cities and towns.

29.1.3 The gap between supply and demand of milk in cities continued to grow and acute shortages became patent in more and more areas. Widespread adulteration of milk with water and undesirable practice of urban milk production came into existence and became a

part of the general system of dairying in the country. Because of shortages, prices of milk and milk products continued to soar higher and higher taking these out of reach of the poorer sections of the community. Impoverishment of the villages and tempting price in urban areas funnelled out milk and milk products from many rural areas leaving little to meet the village needs. Due to low per capita income of people in rural areas, milk consumption is at a low level even in those villages where milk does not flow out to the urban areas.

29.1.4 After Independence, with the initiation of Five Year Plan programmes, dairying has progressively been receiving more and more emphasis and getting greater allocation of funds. There is a growing realisation that promotion of dairying not only contributes towards national health building but also creates substantial employment opportunities. Properly organised and developed, dairying could be effectively used as an instrument of social justice.

29.1.5 Organised dairying has three functions. viz (a) production of milk, (b) collection and processing of fluid milk and milk products, and (c) marketing of milk and its products. In this chapter we discuss mainly collection, processing, packaging and sale of milk and milk products. Milk production and connected subjects of breeding and management have been discussed in detail in Chapter 28 on Cattle and Buffaloes. The feeding of cattle and buffaloes has been dealt with in Chapter 34 on Livestock Feeding and in Chapter 25 on Fodder Crops. Chapter 35 covers the subject of Animal Health. Dairy Education has been discussed in Chapter 53 and Research in Chapter 52. Attention is also invited to Chapter 55 on Credit and Incentives. In order to consider the development of dairying in the country in proper perspective and its prospects for the future, a brief review of the progress given below may be of help.

2. REVIEW OF PROGRESS

29.2.1 The first official move for organised dairying in the country was taken during the British regime when military dairy farms and creameries were established towards the end of the 19th century to meet the demands of the forces and their families. Efforts were also made to encourage private entrepreneurs to manufacture wholesome table butter, particularly for the British troops. As a result, modern Dairy plants were founded mainly for the manufacture of table butter at Aligarh, Bombay, Calcutta, Darjeeling, Kanpur, Poona and some other towns by Messrs Keventers in the early part of the 20th century.

Messrs Polsons started manufacture of table butter in 1915 in Bombay primarily for use by the British military personnel.

29.2.2 With the establishment of military dairy farms and with the beginning of commercial manufacture of dairy products in the country, the necessity arose to organise training courses for the local people to acquire competence in the operation of modern dairy plants and in the handling and processing of milk and milk products. In 1916, the Board of Agriculture of the Government of India reviewed the position of dairying and recommended the appointment of an Imperial Dairy Expert. The expert was to organise training programmes, and advise the Central and Provincial Governments on improvement of dairying and establishment of commercial dairy industry in the country. The recommendation of the Board was accepted by the Government of India and the first Imperial Dairy Expert was appointed in 1920. The Imperial Institute of animal Husbandry and Dairying was established in 1923 at Bangalore to function under the control of the Imperial Dairy Expert and a two year diploma course in dairying (IDD) was initiated at the Institute.

29.2.3 On the question of milk supply, the Royal Commission on Agriculture (1928) expressed the opinion that in India a cow for dairy purposes should average 5,000 lb (2,300 kg) of milk during a lactation period and the aim should be to get an animal with an average of 8,000 lb (3,600 kg). The Commission recommended improvement of indigenous breeds of cows and buffaloes by selection in preference to crossbreeding of indigenous cows with bulls of exotic dairy breeds. They further recommended that municipal corporations of the larger cities, in addition to organising cooperative societies for the supply of milk should promote the establishment of large dairy farms and devise means by which capital and business ability may be attracted to large scale milk production. The Commission was of the view that the cooperative milk supply societies could not solve the problem of urban milk supply at cheap rates so long as milk production was based on poor fodder and low producing cattle.

29.2.4 Dr. N. C. Wright, the Director of Hannah Dairy Research Institute, UK, was invited by the Government of India in 1936 to study the then existing dairy situation and to recommend measures for further development of dairying in the country. His recommendations focused on measures to organise milk production, such as the registration of all cattle and on the need to organise hygienic city milk supplies. One of the most important recommendations made by him was establishment of a dairy research institute of high standard in the country.

29.2.5 At that time the portent of another World War was looming large which put new pressure on the Imperial Government to provide indigenous supplies of milk and milk products for British troops. Efforts were made to meet the demands of the newly developed situation through private enterprise. Because of this move, Polsons Dairy, for example, attempted to manufacture cheese for the troops from milk procured in Kaira district in Gujarat while stepping up their procurement of cream for production of butter.

29.2.6 The Directorate of Marketing and Inspection of the Government of India published a Report on the Marketing of Milk in India¹ in 1940 and on the Marketing of Ghee and other products in 1950². These reports contained information on production, processing and marketing of these products and recommendations and schemes for the organisation and improvement of the related industries and markets. The Directorate also laid down standards for purity and quality of ghee and creamery butter and initiated their grading under the Agmark Act in 1938 and 1941 respectively.

29.2.7 In accordance with the recommendations of Wright, the Imperial Institute of Animal Husbandry and Dairying was reorganised in 1941 and renamed the Imperial Dairy Institute. In 1944, the Government of India created the post of Dairy Development Adviser who was to have substantially the same duties as that of the erstwhile Imperial Dairy Expert.

29.2.8 In 1945 Mr. R. A. Pepperall, Chief Executive Officer of the Milk Marketing Board of the United Kingdom was appointed as the Milk Marketing Adviser to the Government of India for advice on development of milk marketing on sound lines. Drawing attention of the Government to the lack of organisation of various functionaries in the milk business and the low efficiency of the industry, Pepperall³ recommended *inter alia* the setting up of Milk Commissions in each State with a Commissioner, paid Director and a nominated Advisory Board.

29.2.9 The Famine Inquiry Commission (1945) emphasised *inter alia* the need for developing feed and fodder supply for increasing milk production and recommended the adoption of mixed farming with a place for fodder in crop rotations. The Commission recommended a study of the place of milch animals in the farming economy of small holders in different places and the cost of milk production. It emphasised the need for increase in the milk production and consumption in villages and the need for a Milk Policy for urban milk

¹ Directorate of Marketing and Inspection, 1940. Report on the marketing of milk in India and Burma.

² Directorate of Marketing and Inspection, 1950. Report on the marketing of ghee and other products in the Indian Union. Marketing Series No. 50.

³ Pepperall, R.A. 1946. The dairy industry in India. Report on an investigation with recommendations, Government of India Press, Simla.

supply that should recognise the prior claims of the vulnerable groups.¹

29.2.10 In 1945, the Government of India decided to take measures to safeguard supply of hygienic milk to major cities. A beginning was made in Bombay and for the first time in India, milk produced in rural areas of Kaira district was collected in bulk, pasteurized and transported by rail for distribution in Bombay. Regulatory orders were passed for controlling the movement of milk, milk products and cattle in the milkshed of Kaira district to protect the scheme for milk supply to Bombay.

29.2.11 Dr. H. D. Kay, Director, National Institute for Research in Dairying, England was invited by the Government of India to study the situation of research in dairying. In his report², Dr. Kay recommended *inter alia* that the central dairy research institute then located at Bangalore should be shifted to an area more typical of the dairy regions of the country. He also recommended that for a study of the problems of individual regions, regional stations might be established.

29.2.12 The Milk Sub-committee of the Policy Committee on Agriculture³ recommended organising collection of rurally produced milk through Government agency, private enterprise or producers' cooperatives and its transport to urban areas. The Subcommittee further recommended replacing numerous agencies concerned with milk distribution by a few selected agencies (even to the extent of granting a monopoly) and constitution of a Milk Control Board in each town with powers to control purchase and sale prices. The milk supply to cities, the Subcommittee visualized, should be reorganised zone by zone so that gradually the entire milk supply for the cities is drawn wholly from the rural areas. It was recommended that every organised attempt at developing the industry through private enterprise should be encouraged by supplying plant and machinery, interest free loans and an assured price for milk which may be subsidized, if necessary.

29.2.13 The then Government of Bombay took a number of measures on the milk front as early as 1943 by starting a subsidised milk distribution scheme. The scheme was operated by the Bombay municipality and the Government of Bombay met all the expenses and the subsidies. Salvaging dry buffaloes from Bombay stables was also undertaken and for that purpose Government dry-stock farms were established. Permits for import of new buffaloes were given strictly against the number salvaged by a stable owner. To make milk available for the subsidised scheme, and to conserve the supply generally,

1 Famine Inquiry Commission, 1945. Final Report of the Famine Inquiry Commission, Government Press, Manager of Publications, Delhi.

2 Kay, H.D. 1946. Report on dairy research, dairy education and dairy development in India, Government of India Press, Simla.

3 Report on the marketing of milk in the Indian Union 1950. Marketing series No. 64. pp. 154-156. Directorate of Marketing and Inspection, New Delhi.

hotels and restaurants were banned from using fresh milk for tea, coffee and ice-cream, under the Defence of India Rules. Instead, they had to use skim milk powder, imported and supplied exclusively by the Government to the hotel trade. The reconstitution into milk was done by the thousands of users themselves. Thousands of tons of skim milk powder were sold leaving high profits to the Government—crores of rupees—which were subsequently spent on the removal of the city cattle to the milk colony at Aarey.

29.2.14 After spending over Rs. 3 crores, the subsidised milk scheme was closed down on February 28, 1947, and in its place a nonsubsidised distribution scheme was started from the next day. The programme for the removal of 15,000 cattle from the old city limits of Bombay to the Aarey Milk Colony was approved by the Government and construction of the colony began in January 1948. The first batch of buffaloes moved in March 1949. Pasteurised and bottled milk was put up for sale for the first time in India for use of the common man on December 15, 1950 from the first large dairy set up at Aarey. During this period the Kaira District Cooperative Milk Producers' Union was formed and it started supplying pasteurized milk to Bombay from Anand 400 km away.

29.2.15 Likewise, in Bengal under the post-war reconstruction programme, departmental work began with the planning and setting up of the Central Livestock Research-cum-Breeding Station at Haringhata. This station was to be equipped with modern milk processing plants for supply of the processed milk to Calcutta. Although work on this project started in 1944, it could not unfortunately be proceeded with because of the 'Standstill Agreement' that was effective on the eve of Partition of Bengal at the time of attainment of Independence in 1947. Work was restarted after 1947 and it could be completed only in 1949. The Greater Calcutta Milk Scheme was initiated and pasteurised bottled milk began to flow from Haringhata to Calcutta.

29.2.16 In the First Five Year Plan (1951-56), the programme for dairy development was initiated in a relatively small way as funds for dairy development were made available only out of overall savings from other sectors. Work on dairy development was undertaken in the States of Andhra Pradesh, Bihar, Madhya Pradesh, Orissa, Tamil Nadu and Uttar Pradesh. In 1955, the Indian Dairy Research Institute transformed as the National Dairy Research Institute (NDRI) was shifted from Bangalore to Karnal. The southern regional station of the newly created National Institute opened in Bangalore.

29.2.17 In the Second Five Year Plan (1956-61), dairy development programme envisaged the establishment of 36 liquid milk plants for supply of milk to large consuming centres with more than 100,000

population ; three creameries, three milk products factories and expansion of some cattle salvage and fodder farms. The Second Plan included expansion of the NDRI and its southern regional station at Bangalore and establishment of two more regional stations at Calcutta and Bombay to meet the requirements of trained personnel for the industry as well as research. During the Second Plan period, 7 liquid milk plants were completed ; 8 pilot milk schemes as precursors to the establishment of main dairy plants were started along with establishment of 3 milk creameries and 2 milk products factories. In addition, civil works on 31 milk supply schemes were in various stages of construction during the plan period. Four new cattle salvage farms were established. Two new regional stations of the NDRI, one at Calcutta and the other at Bombay came into existence.

29.2.18 The Third Five Year Plan (1961-66) included establishment of 55 milk supply schemes for cities and industrial townships ; 8 rural creameries ; 6 milk products factories ; 2 cheese factories ; 4 cattle feed compounding factories ; and completion of spill-over schemes of the Second Plan. During this Plan period, 23 liquid milk plants and 27 pilot milk schemes were in operation and the daily average throughput of milk in the organised sector was 1,300,000 litres. Four milk products factories and three creameries were also commissioned. Work on the establishment of another 37 liquid milk plants was initiated. In order to meet the requirements of technical personnel, training programmes were also intensified.

29.2.19 In 1962 the Government of India constituted a Working Group to study the prospects of development of dairying and animal husbandry through cooperative organisations. The Working Group recommended that where village service cooperatives were functioning satisfactorily no separate milk producers' cooperative need be organised. The service cooperatives should adopt supplementary bye-laws to enable them to take up milk business. Where separate primary milk producers' societies had been set up they should continue. Where no village service cooperatives existed or where there was a concentration of rural milk producers, whether or not they are cultivators, separate milk producers' cooperative societies should be organised. The Group also recommended that to provide coordination, technical assistance and guidance, State federations of dairy cooperatives should be organised at the State level and an All-India Federation might be organised to coordinate the work of the State federations. The Working Group agreed with the proposal made in the Third Plan that dairy development should be attempted through cooperatives and recommended steps for implementing this policy. It was suggested that dairies with a capacity of 20,000 litres or below and "at least 50 per

cent of the milk products factories should be in the cooperative sector and the remainder in the public sector". The Group gave model bye-laws and working plans, identified the capital needs for a cooperative and indicated the pattern of financial assistance and support that should be provided by Governments and banking institutions.

29.2.20 The organisational set up best suited to milk production, procurement and marketing had been evolved during the first three Five Year Plans. During the mid-sixties it was clear that the dairy development programmes of the country could be best served by effectively linking up milksheds with major urban markets. The Anand and Bombay linkup provided a good example. The National Dairy Development Board (NDDB) registered under the Societies Registration Act of 1860 and the Bombay Public Trust Act of 1950 was set up by the Government of India in 1965. It was charged with the major objective of providing, on a non-profit basis, any technical services which implementing agencies might require in building up their dairy projects. These services were designed to help build up rural milk producers' cooperatives based on the lines of the Kaira District Co-operative Milk Producers' Union Limited. In the Annual Plans between 1966 and 1969 the emphasis was on the consolidation of the existing dairy projects.

29.2.21 The physical targets under the Fourth Plan (1969-74) envisaged setting up of 41 milk supply schemes, 11 milk products factories and 43 rural dairy centres. Of these, 6 milk supply schemes, 2 milk products factories and 32 rural dairy centres were commissioned. Many projects originally included in the earlier Plans spilled over to the Fifth Plan. The project 'Operation Flood' was conceived and formulated by the NDDB during this period. But as this organisation was not authorised to transact any financial and commercial activities, the Central Government set up the Indian Dairy Corporation to execute this project.

29.2.22 The five year 'Operation Flood' project was initiated in July, 1970. This is the world's biggest milk drive launched in any country. Some detailed information about the project would, therefore, be of interest. This is given below :

"This project aims ultimately at establishing a broad basis of accelerated development for our national dairy industry. In accordance with the agreement signed between the World Food Programme (WFP of the United Nations/FAO) and the Government of India, the WFP will arrange to supply during the project period, 1,26,000 Metric Tonnes of Skim Milk Powder and 42,000 Metric Tonnes of Butter Oil, which the Corporation will handle on behalf of the Government of India. Utilisation of these commodities over the project period would

generate funds estimated at Rs. 954 million. These funds are to be invested as scheduled in the Plan of Operations mutually agreed to between the Government of India and the WFP. The Project aims at the improvement of milk marketing by enabling the organised dairy sector to obtain a commanding share of the markets in the four major cities of Bombay, Calcutta, Delhi and Madras and at speeding up dairy development by increasing milk procurement and production in the rural areas which supply milk to the four major cities. The rural areas mainly concerned with supplies of milk or cattle to the four cities extend over ten States, viz., Punjab, Haryana, Rajasthan, Uttar Pradesh, Bihar, West Bengal, Tamil Nadu, Andhra Pradesh, Maharashtra and Gujarat. The entire investments have been broadly grouped into eleven action items. Six of these, estimated at Rs. 807.9 million are to be implemented by the implementing agencies designated by the concerned States. The programmes covering the remaining five items, estimated at Rs. 146.1 million, are the direct responsibility of the Corporation. In order to achieve the desired objectives of the project, the following order of implementation has been adopted :

- Quick expansion of urban handling capacities by expanding the existing major city dairies in Delhi, Bombay, Calcutta and Madras and by setting up new liquid milk plants, so that the total capacity of the organised sector* would be increased from a pre-project throughput of 1.00 million litres a day to 2.75 million litres a day altogether in the four major cities.
- Supply of WFP commodities—skim milk powder and butter oil—for production of recombined milk to help speed up full utilisation of the expanded capacities mentioned above.
- Setting up of rural milk producers' own cooperatives' organisation, to procure, process and market milk on the one hand, and to market technical inputs for milk production on the other.
- Implementation of the milk production enhancement programmes with the longer term objective of achieving self-sufficiency in milk.
- Establishment of rural feeder/balancing dairies to mop up existing milk available, to replace recombined milk produced by use of WFP commodities.
- Development of the basic transportation and storage network to facilitate regional and seasonal balancing of milk supply and demand.
- Resettlement of milch animals from the four cities in the rural areas as a result of economic pressure created in the urban areas by large outputs of milk from the city dairies.

* excluding the milk plants in other cities than Bombay, Calcutta, Delhi and Madras.

As with many large and ambitious projects, it has not been possible for the time table to be maintained for Operation Flood. There were initial teething problems such as late arrival of the equipment needed to expand the existing city dairies, and there were procedural delays in the execution of programmes by the concerned Governments. Subsequently, non-receipt of Skim Milk Powder and Butter Oil on schedule contributed to further delay and also to underutilisation of expanded capacity of the dairies in the four cities."¹

29.2.23 The Operation Flood Project has now been extended by two years. By 1975, work on expansion of the capacities of the existing dairy plants in Bombay, Calcutta, Delhi and Madras had been completed and two large new plants were commissioned in Delhi and Bombay. A new large plant for Madras is almost complete and construction of a similar plant for Calcutta is proceeding rapidly. Besides these large urban dairy plants, establishment of 13 new and expansion of the capacity of 7 existing rural (feeder/balancing) dairy plants have been planned. Out of these, two new plants have already been set up and work on expansion has been completed in 5 plants. Each rural dairy complex is equipped with facilities for providing animal health coverage, breeding service, balanced feeds, fodder development and dairy extension work.

29.2.24 Including the new dairies under the Operation Flood project, 100 dairy plants and 62 pilot dairy schemes have been set up up to the end of 1974 under government and cooperative sectors. Of these 100 dairy plants, some 94 are managed by government either departmentally or through newly created State Dairy Development Corporations. The dairy plants in government sector and two out of the six dairy plants in the cooperative sector are concerned only with milk collection, processing and sales. These dairies have not taken the responsibility of distributing inputs for increasing milk production. To develop dairying on proper lines, the organisation which collects milk should also bear the responsibility of channelising inputs for milk production enhancement. This situation does not exist except in case of cooperative dairies of Gujarat. Operation Flood project adopts this approach in all its project areas on the model of successful Gujarat cooperative dairies. It is encouraging to note that other States are also gradually adopting this system.

29.2.25 In the Fifth Five Year Plan (1974-79) it is proposed to set up 64 liquid milk plants, 11 milk products factories, and 127 rural dairy centres and complete 36 spill-over schemes and consolidate the existing liquid milk schemes and milk products factories.

¹ 1973-74 Fourth Annual Report of the Indian Dairy Corporation. pp. 3-4. Indian Dairy Corporation, Baroda, Gujarat.

29.2.26 The importance of dairy development in India was recognised internationally in the holding of the 58th Annual Session of the International Dairy Federation (IDF) and the XIX International Dairy Congress (IDC) in New Delhi in 1974. This is for the first time that these meetings of the Dairy World were held in a developing country. The XIX IDC was of particular significance to India as its main theme was "Dairying as an instrument of social and economic change"—a thinking which was portrayed in 1971 in our Interim Report on Milk Production through Small and Marginal Farmers and Agricultural Labourers (hereinafter referred to as Interim Report on Milk Production).

29.2.27 If dairying is to be developed in the country on proper lines, then in addition to enhancement of milk production a proper marketing system has to be developed.

3 MARKETING

29.3.1 Efficient organisation and management of the marketing of milk require development of suitable systems for procurement, collection, processing, packaging and sale of fluid milk or products. In order to make proper plans for management in each sphere mentioned, consideration needs to be given to the supply-demand situation, consumption of milk and its products keeping in view consumer preferences.

Present Supply-Demand Situation

29.3.2 In the Interim Report on Milk Production, we have pointed out that the present level of production of milk in the country is far short of requirements. According to an estimate that we have made in Chapter 10 on Demand Projections, the annual demand for milk and milk products is expected to range between 33.37 million tonnes (low) and 44.17 million tonnes (high) by 1985 and 49.36 (low) and 64.40 (high) million tonnes by 2000 AD. Apart from the question of technological possibility of production of this quantity of milk an important factor that would determine the level of milk production and demand is the purchasing power of the people.

29.3.3 Effective demand for milk and milk products is in essence, a function of dietary habits and food preferences, size of population and real incomes. Examining these factors we find that (a) the preference for milk and milk products is strong and is deeply rooted in the national food habits, (b) the population has been growing faster

than the rate of increase in milk production, and (c) a major national objective is economic growth with social justice which calls not only for an overall increase in real incomes but also for increases especially in the incomes of the poorest families. Income elasticity for demand of milk is the highest in this segment of population.

29.3.4 To some extent, milk can be made available to the poorest families in urban areas by administered prices and selective subsidies. This is impossible with regard to the rural population. The further the effective demand outstrips production, the greater will be the price increase taking milk beyond the reach of the poorest groups of people. The real solution for milk supply for all lies in increasing milk production by improving the yield of dairy animals.

29.3.5 The problem of supply demand imbalance is exacerbated by regional and seasonal imbalances. We are informed that consumers in poorly connected demand centres, for example, pay Rs. 3 per litre of milk at the same time as producers in poorly connected production centres may be selling at Re. 1 per litre¹. Within a region, gross seasonal imbalances result as procurement in the milksheds declines during the lean season to nearly one-third of that of the flush-season with demand remaining almost constant all the year round.

29.3.6 There is greater seasonal fluctuation in milk production in the buffalo than in the cow². Under the present system of dairying in the country, relatively much lesser quantity of cow milk is procured. This is partly because of irrational pricing policies and partly because most milk producers have no access to cows with high milk production. The demand for milk and milk products can be expected to grow more rapidly as the national economic and social objectives are progressively achieved. The supply-demand imbalances would thus become greater unless appropriate corrective measures are taken simultaneously. The following measures can be taken to offset the possibilities of the imbalances becoming greater:

- (i) Production of adequate quantity of milk to satisfy the market demand;
- (ii) Development of efficient systems of movement of milk in fluid or in conserved form, particularly from poorly connected supply centres to the demand centres;
- (iii) Adequate facility to conserve surplus milk in the flush-season for utilisation in the lean season; and

1 Dairy Development Project for Panch Mahal (Gujarat), 1975. National Dairy Development Board, Anand, Gujarat.

2 Ray Wiley Nitingale. The modernisation decision in Indian urban fluid milk markets. Occasional Paper No. 17. Department of Agricultural Economics, Cornell University, USAID Prices Research Project.

- (iv) Rational pricing policy to encourage production of milk particularly of cow milk.

Consumption of Milk and Milk Products

29.3.7 The most economic and nutritionally satisfactory way to consume milk is in its fresh, liquid form. However, traditionally, the lack of facilities or techniques to keep liquid milk fresh during transit from rural production area to urban centres of demand has inevitably led to diversion of a large proportion of milk as sweets and other products. The pattern of milk utilisation between 1951 and 1966 is shown in Appendix 29.1.

29.3.8 Prior to the establishment of large sized modern dairy plants and organisation of dairy industry, approximately 40 per cent of the milk produced in the country was reported to be consumed in fresh liquid form. This proportion rose to almost 45 per cent by 1966 as modern facilities for moving fresh liquid milk became available and as urban demand pressure attracted milk production towards towns and cities.¹ With modernisation of dairy industry there has been a rapid increase in the creation of facilities required for manufacture of non-traditional milk products as shown below :—

Dairy products	1974 installed capacity (tonnes)	1974 production (tonnes)
baby food	34,128	11,174
milk powder (whole and skim)	33,259	13,900
condensed milk	17,886	6,000
malted milk food	22,500	15,347
table butter*		15,000

Source: Directorate General of Technical Development through the courtesy of Union Ministry of Agriculture.

*Butter manufacture is not subject to licensing. The production figures of 15,000 tonnes is therefore an estimate.

29.3.9 As can be seen from the above, milk powder production capacities remain very much underutilised. One possible reason for this may be that, in the past, urban dairy plants that depended on milk powder to increase their production of liquid milk, preferred using imported powder as it was cheaper than the indigenous product. It is also possible that milk drying capacities have been developed without due attention to the infrastructure required around such plants for procurement of milk and for increasing milk production. With the efforts now being

¹ Statistical abstract of the Indian Union. 1966. Central Statistical Organisation, Department of Statistics, New Delhi.

put in for dairy development, indigenous production of milk powder and butter can be expected to rise significantly. Operation Flood project will more than double the milk powder production capacity.

29.3.10 Skim milk powder and white butter are used for reconstitution of liquid milk. Such conservation of milk and its subsequent use can be expected to increase considerably its consumption in liquid form, albeit recombined liquid milk. If annual milk powder production capacity is raised to say, 50,000 tonnes and butter capacities to a proportionate figure, it would provide for conservation of about 2.3 per cent only of estimated milk produced during the year. Considering that such processing facilities require investment in plant and equipment of approximately Rs. 200 per litre per day, the small percentage of milk conserved is not surprising. On the other hand, the traditional methods of making milk products, like *ghee*, *pedas*, *burfi*, *rosogulla* and other chhanna based sweets and *dahi*, represent indigenous methods of production of milkfoods that make movement of milk over long distances possible without any heavy investment in plant and equipment. Moreover, dietary patterns and preferences are so deeply ingrained that consumers who can afford, pay substantial premia for such traditional products.

29.3.11 There is often a tendency, though unrealistic and unjustified, to decry the consumption of such popular products, as if it amounts to supporting profiteering and antisocial activities. In actual fact traditional milk products are providing a profitable market for the excess milk, particularly during the flush-season. Otherwise much of the milk would perish while consumers would go without delicious and nutritious foods which they value. Judged by the premia the consumers are ready to pay for such milk products, it is obvious that these are highly valued.

29.3.12 Development of organised dairy industry should not imply denial of traditional milk products to the consumers. On the contrary, organised modern dairy industry must aim at meeting not only the demands of fluid milk but also those of traditional and non-traditional milk products. It is obvious that this would be possible only when there is sufficiency of milk production to meet these demands of fluid milk as also of various milk products. 'So long there is insufficiency of milk production as at present, and as long as adequate supply of conserved milk solids for reconstitution into fluid milk cannot be ensured, however much one may dislike it, some restrictions on consumption of milk during the lean periods seem unavoidable. This is because there is no alternative to such restrictions if an uninterrupted supply of fluid milk to vulnerable sections of the population, viz., children, expectant mothers, babies, the old and the sick is to be maintained.

29.3.13 The measures that we have indicated in Chapters 28, 34 and 35 if fully implemented, would bring about sufficiency in milk production to meet the requirements of city milk supply and production of traditional and non-traditional milkfoods. At present the traditional products of ghee and butter are being manufactured in increasing quantities by the organised dairy sector and these products have been very well accepted by the consumers. Several non-traditional milk products like milk powder, baby-food, malted milk, condensed milk, flavoured milk, ice-cream, chocolate, toffee, cheese, casein etc. are also being produced in limited quantities in the organised public, cooperative or private dairy products manufacturing plants. Processed cheese from buffalo milk has been successfully developed and is now being produced on a commercial scale by cooperative and public sectors. The standard and quality attained for manufacture of these products compare favourably with those attained in countries abroad with developed dairy industry.

29.3.14 The installed capacity of most of the milk products manufacturing plants is at present underutilised. As mentioned in the previous paragraph, with progressive increase in milk production greater quantities of milk would be available for production of traditional and non-traditional milk products. The organised dairy sector should constantly keep these prospects in view so that keeping in step with growing market demands these products may be manufactured in larger quantities. Several of these products besides being absorbed in the local market have the potentiality of export. Keeping in consideration the market demand for traditional milkfoods delicacies now being produced exclusively by traditional methods we suggest that techno-economic feasibility studies should be undertaken, without delay, on large scale production of traditional milkfood delicacies in manufacturing plants. Techno-economic studies should determine the optimal balance required between processing of fluid milk and manufacture of milk products for a dairy organisation to become profitable commercial enterprise under different situations.

29.3.15 In course of the preparation of some traditional milk products, there is loss of whey—a valuable by-product. The NDRI has developed a delicious beverage out of it. We recommend that processes for utilisation of by-products should be similarly developed and commercially exploited. We further recommend that the NDRI, Central Food Technological Research Institute and other concerned institutions should standardise the methods of manufacture of various milkfood delicacies and find out ways of improving their storage, life, flavour and taste as also their packaging. Research studies on these lines are likely to yield good dividends for milk producers as such standardised

products would fetch a better price and have, besides, a good export potential.

Consumer Preferences

29.3.16 Consumer preferences for milk and milk products differ within and between regions. These are largely determined by food habits, cooking customs and level of income. Consumers in the South prefer milk which goes well with coffee, whereas those in the North prefer a high fat milk which will enable them to make ghee. Other consumer preferences relate to convenience of home delivery, assurance of purity and cleanliness by having milking done in one's presence. According to income, consumers readily pay for these preferences.

29.3.17 Twenty to twentyfive per cent of the milk solids consumed in large cities is reported to be in the form of readymade marketed products and an equal amount is prepared at home¹. As mentioned in the previous paragraph, various factors like food habits, level of income, cleanliness and purity of the product determine consumer preferences for milk and milkfoods. In the case of readymade milk products other considerations like taste, flavour, texture etc. materially influence consumer preferences. Current market prices indicate that consumers prefer to pay much higher premia on readymade milk products than on liquid milk. This high market price is a legacy of the past, when these products were made available out of season and people developed a liking for them.

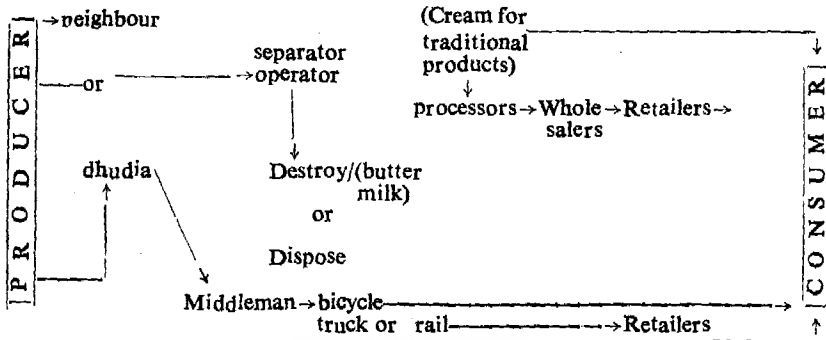
29.3.18 Customer satisfaction is a cardinal principle of marketing. We are, therefore, of the opinion that while organised dairy industry is being developed in the country, there should be a constant endeavour, subject to techno-economical feasibility, to satisfy consumer preferences. Marketing systems, instead of being uniformly the same all over the country should be developed keeping in view regional and group preferences of customers.

Procurement and Transportation

29.3.19 There appear to be no reliable figures on actual proportion of milk which is marketed by the traditional channels. It is known that even in villages which are not marketing milk outside there is trading in milk between producers and non-producers which include producers whose milk animals have temporarily gone dry. In any milk pocket where the modern dairy industry tries to organise procurement, it is

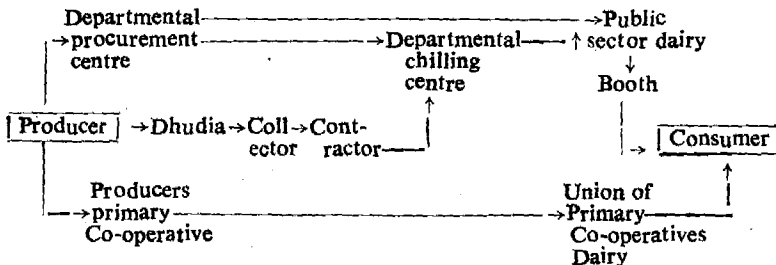
¹ National Dairy Development Board, Anand, Gujarat, 1971-72. Urban milk demand and milk production studies, Delhi, Calcutta, Madras and Bombay.

usually found that approximately one-third of the milk currently produced is already being marketed by traditional methods. The flow-chart given below depicts the typical traditional channels of milk transportation from the producer to the consumer through the retailers.



The traditional channel of milk handling mentioned above does not require an expensive infrastructure such as a dairy plant or other costly equipment, chilling station, refrigerated or insulated vans and employment of technically qualified staff with high salaries. Because of this all the possible permutations of these systems incorporate two features: (a) absence of elaborate and expensive facilities and therefore little capital investment per litre of capacity and (b) absence of direct link between the producer and the consumers. Even when the demand-supply situation compels very high selling price, the producers get very little, the middlemen pocketing the lion's share. It must, however, be conceded that the advantages of low capital demands of traditional systems make the latter hard to replace.

29.3.20 The systems which have grown in the organised sector of dairying can be depicted as follows :



As can be observed from the flow-chart, organised dairies collect milk through one of the following systems : (a) directly from the producers by establishing village procurement centres, (b) from the producers and middlemen alike by establishing milk collection and chilling

centres, and (c) from primary cooperative societies. With the exception of (c) which directly connects the primary producers through their co-operatives with the marketing organisation, none of the other offer much of an improvement over the traditional unorganised dairy sector.

29.3.21 The simplest way of establishing a village procurement centre is to appoint an agent who runs it on the basis of a commission. Many a milk organisation has suffered serious loss because of the mischief played by the agent. Not only did he pay as little as possible to the milk producers, but when an opportunity arose he also diverted milk to more lucrative channels. The running of village collection centres by agents is, therefore, an unreliable system. Operation of village collection centres by paid employees is fraught with similar problems. These are best operated by the milk producers themselves by organising primary cooperative societies. These societies should appoint their own employees, equip the centre with testing, measuring or weighing facilities and operate the collection centre. The chances of malpractices by the paid employees of the cooperative societies are greatly minimised as they work under the constant watch of the milk producers. The employees remain accountable to the producers for the quality and quantity of milk supplied to the dairy plant. Since this system of milk procurement for the dairy plants serves the best interest of the milk producers, we recommend that energetic steps should be taken all over the country to establish strong cooperative organisations of primary milk producers.

Chilling Centres

29.3.22 The most common system of procurement of milk now being followed by most of the government dairies is through establishment of milk collection-cum-chilling centres. The simplest form of milk chilling station is where milk can be cooled by ice. Unless the quantity of milk handled is very small and supply of ice at a reasonable cost is near at hand, this form of chilling becomes inefficient and uneconomic. A chilling plant handling about 10,000 litres of milk per day is reported to add about 6 paise per litre to the cost of milk¹. A chilling station handling smaller quantity of milk increases the cost further. In order to reduce the cost per litre, the chilling plant should be of a size giving the optimum economic return. Generally speaking the minimum size of a chilling plant should have a handling capacity of 10,000 litres/day.

29.3.23 The selection of the size of the chilling plant quite often poses a difficult problem for the dairy organisation. That the opera-

¹ Multilevel dairy management programmes, Part II, 1967. Indian Institute of Management, (figures updated).

tional cost per litre of milk is lower with bigger sized plant is well known, but while taking a decision on the size of the chilling plant, though the consideration of cost of operation is a very weighty one, the extent of availability of milk is also a determining factor. A decision on the capacity of the chilling station should, therefore, be taken in all cases after carefully weighing various factors and keeping in view the primary consideration of economy. Indiscriminate setting up of small size milk chilling stations has in several instances only added to the cost of overheads without improving very much the procurement of milk. Where for special reasons it may become necessary to chill a small quantity of milk, that should be done with use of milk cans with ice cone or the milk temperature should be brought down to below 4°C by chilling the milk cans with ice.

29.3.24 Besides adding to the cost of milk procurement and processing there are other disadvantages of chilling centres. Except the milk producers who are located close to the milk collection-cum-chilling centres, others depend on middlemen to take their milk to the chilling centres. Thus, the establishment of chilling centres may encourage entry of middlemen and associated malpractices and corruption as a consequence of which the small producers are deprived of the due price of their milk and the dairy organisation also suffers financial loss. These problems in the chilling plants would be removed with the elimination of the middlemen by placing the chilling centres in the hands of producers' cooperative unions. Such an arrangement is expected to bring about better functioning of the centres and considerable economy. Chilling centres, however, should be set up by the dairy organisation only when unavoidable.

29.3.25 With good and reliable transport agencies, it should be possible to transport milk in fresh condition from village collection centres to a dairy plant located 50 to 60 km away. Chilling centres may, however, become unavoidable under certain situations e.g. where milk is to be procured from far away places and where transport facilities are not satisfactory. Actually it is the time lag between milking and its receipt at the dairy plant and the associated risk of spoilage of milk that would determine the requirement or otherwise of a chilling centre. While it is necessary to maintain the quality of milk, it is equally necessary that procurement cost is kept down as low as possible.

Feeder/Balancing Plants

29.3.26 It has been mentioned in paragraph 29.3.5 that procurement of milk during the lean season declines to nearly one-third

of that of the flush season, whereas the year-round demand for milk in the city remains almost constant. It has been indicated that one of the measures to meet this demand is to conserve surplus milk during the flush season in such a way that it can be utilised during the lean season. The surplus milk may either be converted into products ready for direct marketing or for reconstituting into fluid milk during the lean season. All interested in dairy development fully agree that farmers should be provided with a guaranteed market throughout the year. It is, therefore, necessary to build up processing facilities that are large enough to process the entire marketable surplus milk during the flush season. This can be achieved with establishment of what has come to be known as Feeder/Balancing Plants as an integral part of a large city milk supply project.

29.3.27 The 'feeder' function of the plant is confined to the despatch of chilled/pasteurised milk in bulk to the city distribution system, whereas the 'balancing' function of the plant is to balance the year-round supply of the required quantity of milk to the cities and conserve the remaining quantity of milk procured in the form of milk products. We are informed that for Bombay city milk supply such a fully integrated system has been developed and is functioning satisfactorily¹.

29.3.28 The main objective of establishment of a feeder/balancing plant at present is to ensure a year-round steady and uniform supply of milk for city milk projects. After performing the 'feeding' and 'balancing' functioning on an elementary level, the feeder/balancing plants may in course of time go in for manufacture of sophisticated products such as baby foods, malted milk, whole milk powder and other milk products which among other things, call for assured large surplus in the milk supply. If necessary, these plants could also undertake processing of aseptic milk in cartons that can be marketed directly without refrigeration. To conserve flush season surplus milk for reconstitution of fluid milk during the lean season, the feeder/balancing plants should have adequate capacities for manufacture of skim milk powder, white butter or butter oil or frozen cream.

29.3.29 With the establishment of a number of fully functional feeder/balancing plants of adequate size in suitable locations within a State, it would be desirable to establish a State milk grid that would ensure steady milk supply all through the year in different parts of the State. Similar developments in the adjoining States may enable the creation of a regional milk grid and with progressive development it should be possible to establish a national milk grid for the whole

¹ Kurien, V. 1968. The Anand and Bombay milk projects. Papers presented at the International Seminar on Change in Agriculture, held under the auspices of the Faculty of Agriculture, University of Reading, England at the Kaira District Cooperative Milk Producers' Union Ltd., Anand, Gujarat.

country.

29.3.30 Creation of the milk grid would require besides establishment of functional feeder/balancing plants, the building up buffer stocks of products like skim milk powder, white butter, butter oil and frozen cream. In order to have a clearer appreciation of problems concerned with the creation of such a buffer stock it is necessary to recount some of the recent developments in relation to imports of skim milk powder, its production in the country and its use for various purposes.

29.3.31 Up till 1974, the liquid milk plants were getting imported skim milk powder for reconstitution to meet the seasonal shortfalls. As the cost of imported skim milk powder was much less than indigenous product, there was no urge for the liquid milk plants to buy the latter. The amount of indigenous production of skim milk powder was also not large, and large quantities of imported skim milk powder were coming to the market even from sources not clearly known. With the Central Government appointing the IDC as the sole canalising agency for all imported skim milk powder. It has now been possible to identify the 'actual users' and review the use of the product. When the price of skim milk powder increased in the world market it necessitated earmarking of a large amount of foreign exchange to meet the requirements in the country. Restrictions were, therefore, imposed by the Government on the use of skim milk powder. As a result of canalising import of milk powder and due to restrictions on its use it has been possible to eliminate use of the product for unauthorised purposes.

29.3.32 Beginning with the winter of 1974 a large volume of marketable surplus milk is being converted into skim milk powder with associated production of butter and ghee. In 1975, large quantities of fresh milk were available to the liquid milk plants even during the summer months as a result of which the need for skim milk powder went down. As a result of this welcome and long awaited development, the milk product factories and the feeder balancing plants were burdened with large quantities of milk powder and butter causing problems of storage and locked up funds. Considering the situation which has developed, the Central Government decided to buy indigenous skim milk powder at a fair price in preference to importing the product at a lower price. Because of this decision by the Government there might not have been any import of skim milk powder in 1975 by paying price. The increased production of skim milk powder coupled with establishment of feeder/balancing plans and proper procurement price of milk promise self-sufficiency in milk powder for reconstitution of fluid milk. We are of the view that a clear-cut streamlined policy should be laid down by the Government for purchase of marketable surplus skim milk powder in order to maintain and improve this favourable position and

create an adequate buffer stock.

National Milk Grid

29.3.33 We have already discussed the physical aspects of systems which use balancing plants to conserve flush-season milk and thereby stabilise urban supplies of liquid milk. We have also indicated in paragraph 29.3.29 earlier, that with the establishment of a number of fully functional feeder/balancing plants of adequate size in different locations within a State, it would be possible to establish, in course of time, a State milk grid. With similar developments in the adjoining States, the basis for formation of regional milk grids would be laid and finally it would be possible to create a national milk grid for the whole country. The Operation Flood Project is planning to create State milk grids as a first step, making the metropolitan city milk supply projects of Bombay, Calcutta, Delhi and Madras serve as the nuclei around which the milk grids for the States that cover the milksheds of these plants could be established. Most of the other States do already have a number of milk schemes which can form the basis of their own milk grid. For proper functioning of the State milk grids, technology is needed which will better enable the modern dairy system to supply the smaller urban communities with fresh liquid milk at less capital cost than the present systems. It is also necessary to develop the storage and long-distance transportation facilities which will enable the State milk grids to be integrated efficiently into a national milk grid. The current phase of Operation Flood proposes to provide the basis of the national milk grid by linking four major cities and their hinterland milksheds in ten States; however, the sooner such linkages are provided on a national scale, the better will the modern dairy system be able to serve both producers and consumers on a national basis. The process of building up the national milk grid should therefore be expedited.

29.3.34 This can best be done by the Central Government charging Indian Dairy Corporation (IDC) with the responsibility of organising the orderly evolution of the national milk grid. The IDC should collaborate with each participating State authority for the organisational arrangement required to see that each such State gets what it wants out of the grid and provides what it can to the grid by way of milk and milk products. As each State evolves its capacity to move milk and milk products and store these for balancing purposes, the sum total of the stored products can constitute the national pool. At present the IDC at the instance of the Central Government is purchasing both imported and indigenous skim milk powder. This stock of milk powder with the IDC can rightly be considered as constituting a part of the

national pool. In future, the national pool can include, besides skim milk powder, other solids-not-fat as also fat based products. It seems logical that IDC should handle the storage and transportation facilities required for the national milk grid so as to ensure distribution of nationally produced milk and milk products in a manner that promotes the viability of the system as a whole and safeguards interests of the poor rural producers and urban consumers all over the country.

Bulk Transport of Raw Milk

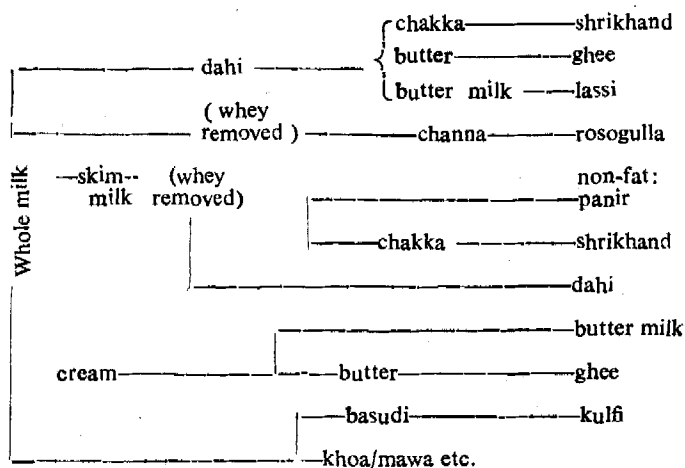
29.3.35 Milk, after being collected at village collection centres needs to be promptly transported to the dairy plant or the milk chilling centre so that it can be heat treated or cooled. The only way to do it is to transport it by road by fast moving vehicles. Depending on the size of operation, the dairy organisation may decide on owning a fleet of vehicles or engage trucks on hire. The hiring of vehicles generally turns out to be more economical in the long run for small systems. Dairy organisations owning a fleet of vehicles are unnecessarily burdened with problems of their maintenance and management of a large number of operators. Hiring trucks eliminates some of these problems. Whether vehicles are hired or owned, timing of collection from each village centre should be rigidly maintained by apportioning clear-cut responsibilities to the village society, truck operators and the dairy plants.

29.3.36 Road milk tankers have been found economical and satisfactory for collecting milk from chilling centres provided a tanker load of milk is available for a single trip. The tanker can collect chilled milk at predetermined hours. Road conditions permitting, the milk tanker should be as large as possible to reduce transportation cost per litre of milk. The biggest size road milk tanker used for this purpose in the country so far can carry nearly 14,000 litres whereas a truck can carry about 75 cans of 40 litre capacity each. The advantage of transportation by tanker is thus obvious.

Milk Processing

29.3.37 There is a view that 50—60 per cent of the milk produced in the country is processed by the traditional sector. Out of this quantity about 40 per cent is reported to be processed into various milk foods as diagrammed at the next page.

29.3.38 The organised dairy sector has the capacity to process about 3 million tonnes of fluid milk annually. But this capacity is probably being utilised at a level not higher than 66 per cent. It



may, however, be mentioned that rural feeder/balancing plants operate at much lower levels in lean season even though the throughputs in flush-season may reach the installed capacity. Therefore, some allowance have to be made for the seasonal variations in the procurement of milk while judging the performance of dairies on the basis of the utilisation of the installed capacities. The fluid milk processing plants are mostly in the public sector. As the management of these plants are hamstrung by government rules and regulations and are to a great extent consumer oriented, these plants are generally not in a position to pay to the milk producers prices that are competitive with milk product manufacturing plants. The management is also unable to build up direct links with the producers. During flush seasons when raw milk prices drop in the market, mainly due to lack of adequate conservation facilities, the urban fluid milk plants may get substantial quantity of milk to maintain or even build up additional supplies. During lean seasons, the plants are able to procure only a small percentage of the total milk supply and have to depend heavily on imported milk solids. The average utilisation of 66 per cent of installed capacity of the dairy plants includes recombined milk from imported milk solids (skim milk powder) in case of many of the dairies.

29.3.39 There are ways that could improve the utilisation of the installed capacity of the dairy plants. For example, a higher price offered for milk by a dairy plant in the lean season could induce the producers to offer a higher proportion of their milk to the dairy plant during that period. Feeder/balancing plants which are connected with the urban centres of demand could, if operated with the flexible pricing policies as mentioned above, maximise the flow

of fresh liquid milk to urban consumers while maintaining at the same time a maximal throughput in the conservation balancing system. We are informed that the basis for such a system is being established among Bombay city dairy plants and the milksheds in Maharashtra and Gujarat States, that supply milk to these plants¹. The Operation Flood also aims at establishing this system of flexible pricing in the 18 milksheds covered by it.

City Milk Supply

29.3.40 Over the last two decades, different milk supply schemes have been initiated in different parts of the country. These include pilot milk supply schemes handling as little as 2000 litres of milk and large city dairies with capacities to handle 3-4 hundred thousand litres of milk a day. In very small dairy plants handling costs per litre of milk processed are generally exorbitant and hence these are not in a position to compete with the traditional milk trade system.

29.3.41 Most of the large city milk supply systems operate with bottling plants and market various types of milk and milk products. These are rather cumbersome and expensive. In the light of the experience of these milk schemes, it would be worthwhile to examine the producer to consumer milk marketing systems with a view to providing a fair return to the farmers and better value to the consumers. At present quite a few alternatives are available to bottling of milk for packaging and marketing. These include bulk milk vending, sterilised milk in bottles, aseptic milk in single service containers, single service pouches etc. With the growing awareness that bottling is not the only and possibly not the best method available for delivery of milk, studies are being made at present in different countries on milk packaging and delivery systems. In India, even the question of pasteurisation of milk for the consumers needs to be carefully re-examined, as the consumers in the country are habituated to boil pasteurised milk and are not averse to peculiar flavour of boiled milk. All the expenses on pasteurisation, bottling, and capping thus seem to be wasteful. From an examination of the various alternative methods of milk delivery, it would possibly be found that to meet the requirements of various socio-economic groups a part of milk supply would need to be marketed through bulk vending units, a part in bottles and a part in single service containers.

29.3.42 From the evidence available to us, it appears that it would not be advisable to set up urban dairy plants to handle less

¹ Multilevel dairy management programme, Part II, 1967, Indian Institute of Management, Ahmedabad.

than 50,000 litres of milk per day. We are, therefore, of the view that milk processing plants need not be established in towns and cities with population of less than two hundred thousand but a well organised milk delivery system should be developed for supply of processed milk to cater to the needs of such areas. Establishment of such a system may constitute distribution of loose milk through cans, bulk milk vending units and/or delivery of long-life milk in single service containers. The delivery of milk to such towns and cities should be arranged directly from the feeder/balancing plants.

29.3.43 There is also a need to simplify the milk marketing systems in large cities. At present many of these milk supply schemes have their own procurement organisations and intermediate chilling stations. The functioning of city dairy plants can be considerably simplified by linking each large city milk supply project with one or more feeder/balancing plants instead of building up an elaborate milk procurement organisation. The city milk processing plant should receive milk in bulk from feeder/balancing plants and market a part of the milk in bulk through cans or bulk vending units. The city plants should also be capable of recombining milk from conserved milk products during the lean periods and should receive only the required quantities of fluid milk from the feeder/balancing plants during the flush periods.

Methods for Disposing Milk in Retail Sale

29.3.44 In paragraph 29.3.41 it has been mentioned that bottling is not the only and possibly not the best method for dispensing fluid milk. Various methods that have been developed and used in varying degrees in different city milk supply organisations are discussed below in brief in order to have a better appreciation of the advantages and disadvantages associated with each system.

29.3.45 Bottling system: Operation of dairy plants in India was organised adopting the conventional processing-cum-packaging-cum-distribution system followed in developed countries. This system requires management of pasteurising plants, bottle washers, bottle fillers, cold stores and distribution vans. Several difficulties have been encountered in the functioning of this system under the prevailing conditions in the country. We are informed that in India an amount of 25 to 60 paise is added to the cost per litre for bottling and dispensing of milk. Moreover, there is a risk of the quality of the bottled pasteurised milk deteriorating during summer since milk has to be taken out of cold stores 8 to 10 hours before it can be delivered to the consumers. Unsuspecting consumers, think-

ing that bottling is a tamper proof packaging, put the blame on dairy organisation if milk in bottles is found adulterated. Such adulteration can also take place at any time after milk has left the cold store till it reaches the consumer. The cost of milk bottles, considerable loss due to breakage of bottles, wastage of aluminium foil, requirement of a large number of vehicles add to the cost of milk for consumers. This system is very intensive in its energy requirements. Thus it may not be an ideal system of packaging and delivery of milk under the prevailing conditions in the country. It must, however, be mentioned that being in packed form distribution of milk is easier and comparatively less costly if run efficiently.

29.3.46 Can milk distribution: A simple and economical form of milk distribution is from a milk can, preferably a dispensing can, into the customers' own vessel. If sealed cans are supplied to milk booths and seals are opened in the presence of customers the chances of adulteration are greatly reduced. By frequent analysis of milk samples taken before despatch and during distribution, adulteration can be further checked and responsibility fixed in cases where adulteration of milk is established. When milk is taken out by a dipper for dispensing, the chances of the fat rising to the top and, therefore, the customers getting milk of varying composition are eliminated. Attempts to design tamper proof milk cans with faucets that can be thoroughly sterilized have been made. Use of such cans with frequent shaking of the cans can eliminate objection to can delivery on grounds of sanitation and non-uniform composition of milk during dispensing. We are informed that a contrivance for delivery of measured quantity of milk from milk cans has been developed indigenously¹. Studies on the subject of milk dispensing from cans should be intensified.

29.3.47 Sachet packing: In order to get over the difficulties encountered in handling of bottled milk, some of the developed countries have introduced milk packaging in non-returnable containers. One such non-returnable container is the plastic pouch which is formed from polythene films at the time of milk packaging. This system avoids bottle washing and filling and therefore the space required for the purpose and the capital costs involved. The cost of packaging *vis a vis* bottling is a factor worth examining. This system of milk dispensing has recently been introduced in some places in the country for small scale trial operations. The machinery required for packaging for dispensing milk under this system is not fabricated in the country at present and needs to be imported. It should not be difficult to have the machines fabricated in the

¹ Ray, S. C. 1975. Search for a system of milk distribution. *Indian Dairyman* XXVII (11) 413—19.

country.

29.3.48 Aseptic milk packaging: Supply of sterilised milk in aseptic paper packaging is gaining ground in many countries. The advantage of this system is that the consumers can collect at one time several days' milk requirement like other grocery items. As the milk is completely sterilised, refrigeration facilities are not required for it either at the processing plants or at consumers' homes. Distribution of sterilised milk in aseptic containers for retail sale offers several advantages in a tropical country like India. Milk can be sterilised and packed in rural dairy plants and transported over long distances in ordinary trucks or railway wagons to urban consuming centres.

29.3.49 The main problem in introducing this system of milk dispensing is the present high cost of packaging. There are, however, customers who can afford and will be willing to pay the higher price for the convenience it offers. The machines required for such processing of milk are not manufactured in the country at present. Laminated paper necessary for packaging is also not available locally. According to the IDC fabrication of the machines and manufacture of laminate papers in the country would not be much of a problem. The packaging machines for sterilised milk can be used with advantage also for packing high priced products like ghee, condensed milk, fruit juice etc.

29.3.50 Bulk milk vending: The system of bulk milk vending has recently been introduced in the country by the NDDB. Bulk milk vending is done with use of special tokens which the customers can buy in advance or at the milk vending booth. When tokens are inserted, one at a time, measured quantity of milk is dispensed by the vending machine in consumers' own containers. As the milk remains under chilled condition until it is delivered, the quality is good. Road milk tankers deliver milk to the vending booths reducing greatly the number of distribution vehicles. As there is no bottling involved, the requirements of boilers, bottle washing and filling machines, cold storage space, aluminium cap etc. are all eliminated. A reliable supply of electricity for the operation of this system is very essential. Although the capital costs on vending booths are high, it is reported that it would be more than compensated by reduction in investment costs on bottling lines, cold stores and insulated vans. It has been reported to us by the NDDB that the overall saving compared to bottled milk is about 10 paise per litre. This system has been introduced recently in Anand and Delhi and is being operated at present on a limited scale. It is expected that it will soon be extended to other cities like Calcutta, Madras, Baroda,

Ahmedabad and Gandhinagar. Bulk milk vending, however, needs to be tested on a widescale under different conditions and over a longer period of time for determining the optimal conditions under which this may prove to be the most suitable method for retailing milk in cities.

29.3.51 Milk powder packets: Distribution and consumption of milk in other than the liquid form can be expected to rise in the near future. Consumption of both skim milk and whole milk powder has increased appreciably in towns and cities, in recent years. Packaging of whole milk powder in metal cans adds to the cost of retailing to a considerable extent. Whole milk powder reinforced with vitamins can conveniently be manufactured and for economy and convenience of use, packed in different sized packets or polythene bags in the rural feeder/balancing plants. The milk powder packets or bags can be transported over long distances much more economically than fluid milk and distributed as an item of grocery in departmental stores from where these can be picked up by consumers at their convenience.

29.3.52 Shelf life of whole milk powder in packets will be shorter than in sealed cans, particularly during the summer months. Careful studies are, therefore, necessary before the milk powder in packets is introduced in the market. Each packet should have the expiry date, determined on the basis of studies made, clearly printed. Sale promotion should not be difficult once the consumers get convinced that nutritionally there is not much difference between milk reconstituted from powder and fresh fluid milk. Recently the use of anti-oxidants like Butylated Hydroxy Anisole and Butylated Hydroxy Toluene have been permitted for whole milk powder. This should help in packaging milk powder in cheap packs, will reduce cost and promote increasing use of whole milk powder.

29.3.53 Organised dairy industry is now poised for taking big strides for rapid growth and large scale development. From what has been discussed above it is clear that the past experience in the operation and management of a number of city milk supply schemes has revealed that some of the systems of milk processing and dispensing that were adopted following the practice prevailing in many western countries are not quite suitable under the conditions existing in the country. Several optional systems of milk processing and dispensing have developed in the meantime. Some of these would possibly be more suitable for adoption with or without modification. But suitability or otherwise of a system can be determined only through careful study of the techno-economic aspect of the system worked under different set of conditions.

29.3.54 As an alternative to delivery of milk in bottles, can delivery suggests itself as a suitable system for adoption under certain conditions, especially because of simplicity and economy of operation. Because of this consideration we further recommend that milk delivery system with different kinds of milk cans and more particularly with tamper proof sanitary milk cans with devices for delivery of measured quantities, should be given trial on a wider scale to determine the acceptability of the system to the consumers and convenience and economy of operation of the system. On the basis of the experience gained further studies on designing and remodelling of the cans should be undertaken.

29.3.55 In our opinion techno-economic feasibility and consumer acceptance studies concerning processing, packaging and delivery of milk should be taken up by large city plants in collaboration with the NDDB, NDRI and other institutes having well developed dairy engineering workshop. Such studies would provide information for determining which system would be most suitable for adoption under a given set of conditions and facilitate decision making.

29.3.56 Milk supply to rural areas : What we have discussed so far primarily concerns supply of milk to the cities and towns. In the development of dairy organisation in the country, a subject which has remained much neglected so far is the question of supply of milk and its products in rural areas. It is estimated that the per capita milk consumption in a given city is about 50 per cent greater than that in the hinterland milksheds of the city. The national objective of economic growth with social justice implies that urban-rural inequalities are to be reduced and the development of dairying must, therefore, be planned in a manner that would assist in the attainment of the objective. Consistent with this approach, as the development of dairying would be contributing towards increasing rural income in the selected milkshed areas, a system should be developed to encourage consumption of milk in these areas. In the Kaira District Cooperative Milk Producers' Union, all the village milk procurement societies are selling milk to the village consumers at cost price. We are of the view that while city milk supply scheme is being planned, arrangements should simultaneously be made for sale of milk in the concerned rural milkshed areas as well by the dairy organisation by adopting a system similar to that of the Kaira District Cooperative Milk Producers' Union.

29.3.57 Just as development of dairying is expected to increase productivity and income in selected rural areas where milk production can be most economical, so will other programmes of modernised agriculture and industry increase the per capita income in other rural

areas outside milksheds. With growing prosperity in such areas the demand for milk also will be on the increase. Dairy development programmes should keep in view such prospective growth centres in non-milkshed localities for organising an efficient marketing system for meeting the milk demands in such areas.

Pricing of Milk and Milk Products

29.3.58 The problem of pricing can most conveniently be first divided into problems of purchase prices and problems of selling prices. Most marketed milk is a "joint product" of mixed farming. Hence, for successful purchase pricing it is necessary that the purchase price should be such as to attract the inputs required for production, such as labour (which, where underutilised, will have a low opportunity cost) and cultivable land, the use of which generally has a high opportunity cost. The more efficient the supply of purchased inputs (such as concentrates), the less is the impact on purchase prices of this necessary condition for success. The sufficient conditions for success include the competitiveness of the purchase price (i.e. its absolute value vs. other prices offered) and of the timing and reliability of payment (which are really other aspects of its absolute value to the producer); the more competitive prices can be reduced, the less of course is their impact on purchase prices.

29.3.59 The necessary conditions for successful selling prices, on the other hand, are more diverse : they must be competitive with others' selling prices, consistent with the objective of social justice—and also consistent with relative consumer preferences and the techno-economics of dairying (e.g. a price structure which raises the demand for milk solids-not-fat to triple the demand for milk fat is not consistent with the techno-economics of our dairying because, in order to produce 3 kg of milk solids-not-fat, 1½—2 kg of milk fat must also be produced). Thus, the administered price of many milk schemes in the sixties, with artificially low prices for toned milk, for example, imputed a zero value to milk solids-not-fat, whereas consumers, in effect, customarily pay for these solids at imputed prices which are equal to 60—70 per cent of the prices they pay for milk fat.

29.3.60 It is thus clear that both the purchase and selling prices of milk in the organised dairying sector have often not reflected the intrinsic values of both milk fat and solids-not-fat. The purchase and selling prices of the organised sector for milk and its products have also often not been competitive with those of the traditional sector. Organisation and modernisation of dairying have only added to the cost of marketing milk rather than increasing milk productivity, and,

therefore the competitiveness. Where the marketing of inputs for milk production has not been integrated into the process of modernisation of dairying, the efficiency with which these inputs are marketed has not improved. It has, therefore, become necessary to offer even higher purchase prices for milk in order to attract these inputs for milk production. The overall competitiveness of the modernised dairy sector *vis-a-vis* the traditional sector continues to be hampered because in diversification of milk and milk products as well as in their pricing, the organised dairy sector generally pays scant regard to consumers' preference.

29.3.61 The generally low quality of service in organised dairy organisations and the absence of traditional milk products from the list of items offered for sale by these organisations place the premia paid for such services and products in the hands of the traditional sector. This renders the organised dairying sector less able to offer purchase prices to milk producers which can compete with those offered by the traditional sector. In short, it can be stated that the pricing problems of organised dairying sector stem primarily from the fact that its prices have not stimulated productivity or reflected the relative values placed on milk solids by consumers. Moreover, the limited items of milk products, and indifferent services offered by most of the modern dairy organisations have decreased their ability to compete with the traditional dairying sector.

29.3.62 We are informed that only about 10 per cent of the total milk handled by the organised dairying sector is cow milk¹ although cows account for nearly 40 per cent of the milk produced in the country. This phenomenon can be attributed in part to the existing pricing systems that often favour the production of buffalo milk. While there is an advocacy for a common pricing of cow and buffalo milk, as stated earlier, a very large section of the dairying industry is paying for milk only on the basis of its fat content. This accounts for the very little quantity of cow milk being handled by the organised dairying sector. A common pricing for cow and buffalo milk may not, however, prove helpful to provide incentives for production of cow milk as there is a prevailing tendency to dilute buffalo milk and pass it as cow milk. Determination of a pricing structure for milk in a dairy organisation has not only to be based on the demand-supply equilibrium but also on the compositional quality of milk. While market forces will determine the base price for milk, milk plants are required to use their own judgment for the price to be paid to the farmers on the basis of the quality of milk. Most dairy plants have some kind of a purchase pricing

¹ Ray Wiley Nitingale. The modernisation decision Indian urban fluid milk markets. Occasional Paper No. 17. Department of Agricultural Economics, Cornell University, USAID Prices Research Project.

policy, which have some kind of relationship to what the plants get from the sale of their milk and milk products.

29.3.63 The cost of production of milk cannot be determined in the absence of relevant data ; any pricing policy not having such a base is bound to be erroneous. Such data are not available at present. A just pricing structure should ensure that production of milk is encouraged and the farmers get a fair return for the milk they supply. The system should have built-in incentives for the producers to supply better quality and larger quantity of milk. Further, consistent with demand-supply situation, the dairy organisation should follow a pricing policy that would ensure the maintenance of an even supply of milk. A faulty pricing policy can lead to a combination of the following undesirable effects : (a) encourage adulteration with water or with fat and solids-not-fat from non-milk sources ; (b) discourage production of one kind of milk while encouraging the production of other kind ; (c) encourage mixing of cow milk with buffalo milk or vice versa ; and (d) encourage malpractices in payment for milk.

29.3.64 To enable the organised dairying sector to attain a commanding control of the share of the market for milk and milk products, some substantial changes are required in the pricing systems now being followed for procurement and sale. In the interest of the organised dairy sector, the pricing system has to be such that it becomes instrumental in increasing milk production by ensuring lucrative returns to the farmers for the produce they sell. For a better appreciation of the different situations under which the pricing systems are functioning in the country for milk procurement, it will be of advantage to consider those in some detail.

29.3.65 Pricing on only fat content : This procedure of milk pricing discourages adulteration with water on mixing cow and buffalo milk with a view to gaining an economic advantage. It, however, encourages partial skimming of milk and adulteration with cheaper fats. One advantage of this system is that it involves simple accounting.

29.3.66 A serious disadvantage of pricing by this system is that it discourages production of cow milk as milk is priced only on the basis of fat content, completely disregarding the solids-not-fat content. For example, cow milk containing 4 per cent fat is paid at half the rate for buffalo milk containing 8 per cent fat, even though the solids-not-fat content of cow and buffalo milk do not differ greatly.

29.3.67 Pricing on species source : Milk pricing is made on consideration of the species from which the milk is obtained, i.e., cow or the buffalo. Usually a minimum fat standard for the different types of milk is adopted for acceptance or rejection of the product. The milk that meets the minimum fat standard, is usually paid a flat price without

regard to its other compositional quality. Such a system provides no incentive for production of richer quality milk. In general, it is known that, as the production rises, the fat percentage of milk goes down and as the production goes down the fat percentage goes up. The milk producers, therefore, do not get any extra payment for the extra fat in the milk during the lean season. Pricing on the basis of species source encourages adulteration of buffalo milk so that it can be passed as cow milk and thus discouraging the production of cow milk. Under this system of milk pricing, the accounting procedures are usually based on volume/weight measurements only and do not take into consideration the total fat and solids-not-fat content in milk. Procurement of milk following this procedure usually leads to malpractices in payment for milk as no effective measures can be enforced to check the material balances during handling.

29.3.68 Pricing on minimum fat percentage plus a premium on additional fat : Pricing of milk on the basis of a minimum fat percentage with a premium on additional quantity of fat requires stipulation of a minimum fat standard and fixation of a base price for that standard. Fat content, over and above the minimum standard is paid for on a pro-rata basis. Usually the basic price takes into consideration the solids-not-fat content of milk as well. This system of pricing is generally applied only to buffalo milk and has the effect of discouraging cow milk production. Though milk fat is accounted for under this system, no effective checks can be enforced on the processing/handling losses of solids-not-fat.

29.3.69 Pricing on total milk solids : The pricing of milk on the basis of total milk solids is mostly adopted by the traditional milk traders. Milk is paid on the basis of the yield of *mawa* or *khoa*. Hence, fat and solids-not-fat are priced at the same level and is, to that extent, not rational. Milk pricing under this system discourages the production of high-fat milk and encourages partial skimming or adulteration with cheaper non-milk solids.

29.3.70 Two-axis pricing of milk : Fixation of price of milk on the basis of its compositional quality can best be made by rationally evaluating the fat and solids-not-fat contents. A pricing policy based on such consideration and termed as the two-axis pricing policy was suggested by the NDDB. In our Interim Report on Milk Production we have recommended acceptance of this pricing policy by the dairy industry. This pricing policy has also been supported by the Committee on Pricing of milk appointed by the Central Government¹. Two dairy companies in New Zealand have started paying the milk suppliers on the basis of a formula that takes into account both fat and casein

¹ Report of the Committee on Pricing of Milk, 1972, Ministry of Agriculture, Government of India.

content of milk¹. According to the two-axis pricing policy, the price of milk is calculated by fixing a pre-determined rate for fat and solids-not-fat. This system discourages adulteration and also provides a common pricing approach to cow and buffalo milk. This type of price structure in effect pays for fat and solids-not-fats, as if they were purchased separately. It is important that milk prices paid to producers reflect the relative values realised by the dairy for fat and solids-not-fat. It has been reported by the NDDB that in the past the market valuations of solids-not-fat ranged around 2/3rd of the value attached to fat. A ready reckoner for payment of milk has been worked out (Appendix 29.2).

29.3.71 Pricing of commodities for sale : The pricing of commodities for sale by the organised dairy industry should be made in a way that would enable the industry to pay remunerative price to the milk producers, cover the cost of collection, processing and distribution of milk and milk products, services rendered in connection with channelising the inputs for milk production and keep a fair margin of profit and yet make the price of the commodities competitive. In pricing the milk products, that are marketed mostly by private enterprises, they do not take into account prices of inputs as they, in general, do not render any service for the marketing of inputs for milk production enhancement. The private enterprises are generally not concerned whether the prices paid to the producers are remunerative or not.

29.3.72 In case of fluid milk marketed by traditional vendors and private dairies, the same is the picture unless they themselves are milk producers. In case of milk schemes, sponsored by the government, the consumers' price is mostly administered so that it is kept as low as possible and is often much lower than the prevailing market price. As a result, it is difficult to pay remunerative price to the producers and thereby induce more production and procurement. As the government milk schemes suffer financial loss, the deficits are met from the State exchequers. The losses in cases of government milk schemes is running in some cases to Rs. 2 to Rs. 3 crores per annum. While there is strength in the argument that the poor section of consumer should get milk at a price within their purchasing power, that does not hold good in case of a fairly large section of urban consumers, whose income is relatively high. In any case, this system thoroughly vitiates commercial management of the plant. Cumulative losses of previous years pile up into dismal figures which can never be wiped out. The sure prospect of the annual loss, and the knowledge that exchequer will bear the burden removes the very healthy check of market economy on the management which is exposed to strong temptations of being improvident or listless.

¹ Indian Dairyman, 1973. 25(9) 383.

Commercial consideration of profit and loss can be described as the primary factor for the success of the Kaira District Cooperative Milk Producers' Union.

29.3.73 We are of the opinion that it is a sound policy and this would also help in the development of the dairying industry in the country to let the organised dairies pursue a policy for pricing of commodities that would make them viable and commercially profitable. The matter of social justice and the rendering of assistance to the weaker sections of the community should not stand in the way of efficient commercial management of organised dairy industry. The Government should take the responsibility for subsidising milk supply to the weaker section. For this purpose differential milk pricing may be introduced on the basis of income of the consumer. Another system that may be considered for adoption is the dual-price policy for milk distributed through urban milk supply schemes as in the case of sugar. Under this system every family can get a certain quantity of milk at controlled price, any additional supplies being at a higher price consonant with the market price.

29.3.74 The only method for maintenance of the competitiveness of consumer price while keeping it as low as possible without reducing the remunerative price for producers is to keep the marketing cost as low as possible. Lower marketing costs can be achieved through better management if efficiency is attained in procurement, processing and distribution of milk and milk products. It is now realised and accepted that rendering of assistance to the milk producers for procuring the inputs required for increasing the milk production should be a function of the dairy organisation as that would be in its own interest. Dairy organisations should, therefore, aim at achieving efficiency in the performance of this function as well. In Gujarat, it has been demonstrated that procurement of milk and providing inputs for milk production enhancement can be achieved most efficiently and at least cost through farmers' cooperative organisation.

29.3.75 Pricing as an instrument of supply and demand management. Milk procurement pricing, can significantly affect the management of milk supply and dairy-plant utilisation. A pricing policy reflecting the value of fat and solids-not-fat contents in milk, can achieve, among other things, parity between cow and buffalo milk, with a consequent stimulus to cow milk production. If, say, 60 per cent of the milk animals in a given milkshed were crossbred cows, fluctuations in milk production could be markedly reduced since seasonal fluctuations of cow milk and buffalo milk production occur at slightly different times of the year. A more direct pricing effect can be obtained if a city dairy plant reconstitutes fluid milk with skim milk powder and frozen cream,

to maintain lean season supplies. The raw material cost of reconstituted milk may well exceed the cost of flush season fresh milk by about 30 per cent. This would mean that the dairy organisation can afford to offer a lean season premium of 30 per cent over the flush season price for fresh milk. It has also been reported that if such a premium were offered, the lean season procurement from a cow-buffalo herd could be expected to fall only to about 77—80 per cent of the flush season peak supply. In case of supply from all-buffalo herd it could be expected to fall to not below 60 per cent of the peak procurement as against the usual procurement of about 30 per cent of the peak supply.

29.3.76 Thus, seasonal price premia can considerably raise average daily procurement, and therefore, average daily plant utilisation. This, in turn, would appreciably reduce the quantity of milk solids that would be required to be conserved for utilisation during the lean season. By adopting a pricing system that would enable a city dairy plant to maintain a constant supply of liquid milk fresh and/or recombined all through the year, it will be possible to reduce considerably the required conservation capacity for milk solids (Appendix 29.3).

29.3.77 It has been reported that establishment of conservation facility requires some 50 per cent more investment in plant and equipment per litre of capacity created, as compared with establishment of capacity simply for pasteurising and chilling in bulk. Therefore, such a reduction in conservation capacity requirement would appreciably reduce the capital cost of the system as a whole.

29.3.78 The Committee on Pricing of Milk¹ set up by the Government of India discussed the trends of prices for milk, milk products and cattle feeds over a decade. They observed that adequate data on cost of milk production, wholesale and retail prices of milk/milk products, feeds and labour were not available. These should be collected if a rational pricing policy is to be evolved and adopted. It is also necessary to make provision for continuous collection of data as an integral functioning of such dairy plant.

29.3.79 The Committee detailed the criteria for a rational pricing policy and recommended, *inter alia*, that a Milk Pricing Committee should be appointed at (a) each dairy plant, (b) in each State and (c) an inter-State authority should be set up to coordinate the activities of the dairy plants that collect milk from more than one State to fix the producer and consumer prices of milk from time to time. The Milk Pricing Committees of the States and dairy plants should be sensitive to the variations in the prices of various inputs for milk production and the benefits that the farmer can obtain by following competitive types

¹ Report of the Committee on Pricing of Milk, 1972. Ministry of Agriculture, Government of India.

of agriculture so that milk production is not discouraged by the pricing structure. The Committees should also keep in view the interests of the consumers and should critically examine the overhead charges for collection, processing and administration so that the gap between the producer and the consumer price is kept to the minimum. The Milk Pricing Committee (Government of India) also was aware of the possible dangers to an honest milk trade from adulterated milk and strongly recommended the strict enforcement of the Prevention of Food Adulteration Act. We endorse the views expressed by the Milk Pricing Committee appointed by the Government of India that it would also assist in the evolution of a National Milk Grid as stated in paragraph 29.3.33. The implementation of the recommendations of the Milk Pricing Committee would assist in the milk production enhancement particularly from the cow.

4 DAIRY PLANT MANAGEMENT

29.4.1 Most of the dairy plants in the country are located in urban areas for milk supply to towns and cities. These have been established and are managed by Government departments. There are some milk product factories which have been set up under private ownership. Attempts to set up modern dairy plants in the cooperative sector have not made much headway until recently except in Gujarat. Some progress in this direction has also been achieved in Uttar Pradesh. In order to consider which type of management may prove to be most suitable to promote dairying in the country, it is worthwhile to examine the functioning of various types of dairy plants that have been established.

Government Owned Dairy Plants

29.4.2 Most of the Government owned dairy plants have been set up under urban milk supply schemes to meet the demand of wholesome milk in towns and cities. It was thought that such dairy organisation would provide remunerative channel for the producers of milk in rural areas. But it appears that most of these Government milk schemes have not been able to promote milk production or satisfy urban demands of milk. These milk schemes depending heavily on imported milk solids have become financially losing concerns. A study of these schemes reveals some inherent weaknesses which are responsible for the present state of affairs.

29.4.3 The milk schemes are run under rules and regulations that

are not suitable to run a commercial organisation on sound business principles. Persons responsible for management of the dairy organisation do not have the requisite powers while these are vested with others who have no direct responsibility in the management of the dairy plants. In the ultimate analysis, there is dilution of responsibilities and, therefore, of accountability. Professional management, very necessary for the growth of the business cannot function effectively with such constraints. Staff in dairy organisations are employed, guided and controlled by general rules of Government service. Because of limitations, these rules cannot serve as effective instruments for motivation of the staff for good performance or make them production conscious. Strict discipline necessary for the growth of a business organisation is absent. Being guided and remotely controlled, the pricing and purchase policies do not respond quickly to market changes. Marketing aspect of the business is thus badly neglected. On top of these serious organisational weaknesses, administrative and political decisions with regard to fixation of procurement and selling prices of commodities often create difficult financial problems for the dairy organisation. Such decisions act at times as disincentives for milk production and procurement or become instrumental in diversion of milk to other channels.

29.4.4 Government dairies were set up when the cooperative organisation had not made a success and performed a useful role in providing a remunerative market for rural milk and a good city supply of milk. The Government milk supply schemes have not been able to build up direct contact with producers of milk. Milk collection and chilling centres are mostly dominated by middlemen who have no basic interest in development of dairying.

29.4.5 Investments on milk production enhancement programmes are done through separate departments which have no responsibility regarding milk procurement. In spite of decline in procurement of milk, the Government milk schemes are often forced to take more commitments for supply. There is heavy demand of milk from milk supply schemes in urban areas mainly because of unrealistically low consumers' price. Consequently, in Government milk schemes, as stated earlier there is great dependency on imported milk solids to tide over milk shortages.

29.4.6 There is a gradual realisation that Government departments are not designed for running commercial dairy plants. So changes are now being effected in the organisational structures and autonomous Dairy Development Corporations are being set up in the States for operating the dairy plants as business enterprise. We are informed that the State Dairy Development Corporations are functioning with

varying degrees of success in different States depending upon the degree of autonomy and the professional competence available in the organisations. Where such organisations are strictly controlled by Government departments or where the Board of Management is unduly influenced by political pressures the results have not been satisfactory. The transfer of management to the Corporation in such cases is merely nominal. Whereas in the instances where the State Dairy Development Corporations have attained effective control of management, distinct improvements have been observed in the functioning of the dairy plants following the changes made.

Privately Owned Dairy Plants

29.4.7 Several major cities have a few small privately owned milk processing plants that market pasteurised liquid milk to the consumers. Many of these have a good reputation for quality, but they cater largely to the demands of the richer minority in the cities and do not contribute significantly to the city's overall milk supply. There are other privately owned dairy product manufacturing concerns that have concentrated their activities mainly on production of luxury products frequently with foreign brand names. Several such concerns working with foreign collaboration have remained mostly only in the baby-food market. These concerns, by and large, lack the advantages of cooperative organisation inasmuch as they cannot have the same intimate relationship with the milk producers. It is sometimes said that privately owned dairies are suitable for production of "sophisticated" dairy products, but it is hard to see any evidence to support such a statement. The most "sophisticated" dairy product made in this country is baby food and indigenous production of this product was initiated by a co-operative.

29.4.8 In general, the privately owned dairies remain on the periphery of the country's dairy development, perhaps because they have not found ways of undertaking urban liquid milk marketing which is the backbone of our dairy marketing and which is characterised by larger scales of operation, lower profit margins than most privately owned dairy business have accustomed themselves to bear. It has been reported that one of the malted milk plants working with foreign collaboration declared eightytwo per cent dividend in its second year of operation.

29.4.9 It has, however, to be admitted that the privately owned dairy plants have also made some useful contributions towards the development of dairy industry in the country. Even the privately owned dairy plants which have been set up under foreign collabora-

tion taking out large amount outside the country as profit and/or royalty have indirectly induced other manufacturers entirely under Indian ownership to come into the field. A few of them have tried to organise procurement of milk directly from the producers and have also introduced some dairy extension service in the rural areas covered by them. These plants, however, do not share the profits with the producers. Furthermore, the cost of providing inputs and services is very high and not so effective, rendering the system inefficient and increasing the overheads, resulting in high consumer price and lower producers' price. However, by establishing these plants in India at a time when 'sophisticated' products like baby-food and condensed milk were not produced in India some foreign exchange was saved as the country was then entirely depending on imports. The situation is different now since the entire requirement of these products is being met indigenously.

29.4.10 Besides the private manufacturers of dairy products mentioned above, there are other groups of privately owned indigenous firms. Some of these deal with fluid milk, and some with products like butter and cheese. Keeping in consideration the useful role the private organisation is playing in promoting the growth of the dairy industry, we are of the view that so long as the private industries do not come in the way of development of cooperative organisation of milk producers, they should be allowed to function subject to their providing inputs for enhancement of milk production in the milksheds. Should, however, a private concern attempt to get into unfair competition with a farmers' dairy cooperative organisation which is a main plank of national policy, it has to be restricted in its activities.

29.4.11 Some joint stock companies are working in the field of dairying. For healthy growth of dairying in the country, it should be enjoined that the companies keep reserved a stipulated minimum percentage of shares for the milk producers in their respective milk sheds. It should also be ensured that the producers have an effective representation on the Board of Management of the companies so that the interests of the producers are fully safeguarded. These measures would encourage the milk producers to participate in the venture of the joint stock companies.

Dairy Plants under the Cooperative Sector

29.4.12 Attempt to develop dairying through cooperative organisations was made as early as 1917 when the first cooperative milk society was formed in Bengal to supply milk to the city of Calcutta. Several dairy societies were established which federated into the

6 M of A&I/76—12

Calcutta Milk Union. A pasteurisation plant was set up to supply pasteurised milk in bottles. Since then several cooperative dairy organisations have been registered in different parts of the country but in actual fact none but the dairy cooperatives in Gujarat grew up into viable dairy complex. Many dairy cooperatives in different States went into liquidation. As the Government took initiative in registering new cooperative milk societies, the numbers continued to increase in spite of liquidation of the old ones.

29.4.13 At present milk is produced by a large number of small and marginal farmers and landless people and the surplus available for being marketed by each individual producer is very small. Pooling of the surpluses has many economic advantages and if it is done through a cooperative society, the benefits of pooling will accrue directly to the producers. However, as most of the cooperatives failed to develop properly, doubts have naturally been expressed in the efficacy of employing the cooperative structure for development of dairying in the country. This has happened in spite of the fact that in most of the developed countries in the world dairying is based on cooperative organisation. It would, therefore, be useful to examine the causes that led to the success of several cooperatives in Gujarat and especially that of the Kaira District Cooperative Milk Producers' Union. The success of the last named cooperative is accepted as outstanding in the country.

29.4.14 The dairy cooperatives in Gujarat State developed an organisational structure described below. Village primary societies have federated directly into a District Milk Producers' Cooperative Union, through which they own and operate their dairy plant, market their milk and milk products produced by the members as also technical inputs for enhancement of milk production through professional managers and technical officers employed directly by the Union. As it is owned by the milk producers, the organisation is responsive to producers' needs. At the same time, it imposes no financial burden on the State exchequer.

29.4.15 After reviewing the role played by private cooperative institutions and dairy projects, we are of the view that dairy development programmes can best be organised by the cooperatives of the milk producers. A recommendation to this effect has already been made by us in our Interim Report on Milk Production. We may recapitulate here some of the salient features of the successful milk cooperatives.

29.4.16 The milk producers should be organised into primary/village level milk cooperative societies. While forming these societies it should be ensured that each village level cooperative becomes a

viable economic entity. The primary societies should also provide the services and inputs such as artificial insemination service, veterinary first aid, sale of cattle feed etc. supplied by the union. The societies should invariably test milk and pay on the basis of quality. The union should make available supply of testing equipment and regular supplies of chemicals for testing. The payment should be made as far as possible twice a day. This results in favourable cash-flow and enables the producers to operate the household budgets with the milk produced. The societies should employ paid secretary and other staff for testing, keeping of accounts etc. The society's staff should be trained by the union for providing services like artificial insemination. The societies should not involve themselves into direct operation of cattle loans as that would lead to favouritism and groupism.

29.4.17 The societies should also ensure that the entire demand of milk in the village is met within the village by offering milk for sale at collection points, preferably at cost price. Persons not involved in production of milk or those associated with private milk business should not be allowed to become members of these societies.

29.4.18 The primary milk societies should be federated into a district level milk producers union which should own and operate the chilling centres, dairy plant, cattle feed plant, artificial insemination centre and semen bank. The union should also provide facilities for health service and dairy extension service. The management of the entire infrastructure owned and operated by the cooperative union should be left to exceptionally competent persons and there should be no day to day interference by the directors of the cooperative union. The general manager of the union should be given full freedom for conducting day to day operations of the union. The board of directors of the union should be elected from amongst the chairmen of the primary societies and the chairman of the union elected by the members of the board.

29.4.19 Technical services and inputs like supply of semen to the primary societies, mobile veterinary aid, supply of fodder seeds, supply of cattle feeds and extension services should be managed by the union. The cost of these services should be included in the operating cost of the union and met and charged to the cost of milk price. The union should also ensure that it realises the best value for the producers' milk. The profits made shall be shared with the individual members of the primary societies. Another key factor associated with the success of some of the cooperatives is concurrent and continuing audit of both the union and primary societies. It enables the cooperatives to use audit as an effective tool of management. The unions should be able to raise finances required for furtherance of their objectives from banks and

other financial and promotional institutions.

29.4.20 Many examples of unsuccessful cooperatives have been mentioned earlier. We recommend that to ensure avoidance of such failures in cooperative ventures in future, the task of forming primary societies as well as the district level unions should be entrusted to a team of specially qualified workers with adequate experience of organising such cooperatives. It is also recommended that wherever milk cooperatives are to be formed the producers from that area should be familiarised with the operation of successful cooperative dairy societies.

29.4.21 The bye-laws of milk cooperatives should be such as to ensure successful formation and smooth and effective operation. Since the objective is to ensure growth with social justice and as about 75 per cent of the producers in the country belong to the weaker sections of the community, we would like to reiterate strongly the recommendation made in our Interim Report on Milk Production that in areas demarcated for dairy development at least 1/3rd of the producers are drawn from groups of small farmers and 1/3rd from marginal farmers and agricultural labourers.

29.4.22 While recommending development of dairying on cooperative lines we recognise that in many areas it may not be possible to introduce complete cooperative structure from the very beginning. In such a situation we recommend that the State dairy corporations may take up the functions of the unions while milk collection should be organised only by primary societies in the villages. The State dairy corporations should, however, promote formation of cooperative unions as soon as possible and handover the operations and the facilities to the unions.

5 MANUFACTURE OF DAIRY EQUIPMENT

29.5.1 With the progress of dairy development in the country, the demand for dairy equipment for milk collection and processing is steadily increasing. Only about 15 years ago, practically all equipment and components had to be imported. Government of India encouraged progressive local manufacture of machinery of various kinds required for the processing of milk and manufacture of milk products. At present, most of the dairy equipment is manufactured in the country by different small and large industries. The Directorate General of Technical Development (DGTD) estimated that while the value of production of dairy equipment was Rs. 3 crores in 1970 it increased

to Rs. 10 crores in 1974.

29.5.2 With the tempo of development taking place in the dairy industry in public, cooperative and private sectors, the demand for dairy machinery and equipment has rapidly increased. The National Dairy Development Board and the Indian Dairy Corporation in their effort to accelerate and harmonize the overall development of dairying, have materially contributed to the awareness of the potential capacity of the country to manufacture sophisticated dairy equipment. The response of the manufacturing concerns in the country to meet the requirements of the growing dairy industry is quite commendable. There are, however, various complex problems viz., import restrictions, high customs duties and problems connected with quality of local raw materials etc. that are impeding further growth of the manufacturing industry at present. In order that there may not be any setback to the dairy equipment manufacturing capacity developed in the country we recommend that these problems should be examined by the Government in collaboration with the NDDB/IDC and concerned or interested parties for taking necessary remedial measures.

29.5.3 Although a large variety of dairy equipment is now being manufactured in the country, there are some sophisticated items which have not yet been taken up for manufacture locally, e.g., separators and clarifiers of high capacity, homogenizers, large ice-cream freezers, heat exchangers etc. The demand for such equipment at present is limited but with the expected accelerated growth of the industry the demand is bound to increase. Moreover, several of these equipment are used for other processing industries. We, therefore, recommend that the possibility of having these equipment manufactured indigenously should be encouraged.

29.5.4 At present some items of dairy equipment are being exported to foreign countries. In the expanding dairy industry of many developing countries there is scope for expansion of export market for the local dairy equipment manufacturing firms. We are of the view that in order to encourage indigenous manufacture of dairy equipment the Government should negotiate with these countries to explore the possibilities for the supply and installation of complete dairy plants on turn-key basis which should include advisory service and training of personnel. If considered necessary, a consortium of public and private equipment manufacturing firms may be established for this purpose.

29.5.5 As it is the policy of the Government of India to attain self-sufficiency in various industries, it is of importance that the dairy equipment manufacturing industry further improves its standards and

design of equipment to suit local conditions and is geared to meet the equipment requirements of the expanding market for processed milk and milk products in the country. To attain this objective, it is necessary to create new additional capacities for production of dairy equipment in the public/cooperative sector. We are informed that the IDC intends to enter the field of manufacture of dairy and allied equipments. The Corporation may be supported in this venture.

6 PROJECTIONS FOR MILK DEMAND, PROCESSING AND MARKETING

29.6.1 The target for milk production by the year 1985 is put at 44.17 million tonnes. We have recommended in Chapter 28 on Cattle and Buffaloes that by 1985 150 districts covering 100,000 milch animals each should concentrate on milk production. It is also anticipated that 4,500,000 milch animals would be covered by cattle development programmes in other areas. Milk production is expected to be more than doubled over the coming decade. It is generally agreed that efficient organisation of procurement, processing and marketing of rurally produced milk would stimulate the production of additional milk as planned. A large proportion of the extra milk would, therefore, need to be processed. This would involve the effective linkage of 150 good milksheds with the urban demand centres.

29.6.2 The present installed capacity of dairy plants in the country is estimated to be 3.0 million tonnes annually. The current throughput of these dairies in the organised sector is estimated to be 2.3 million tonnes. The processing capacity to be achieved by the end of Fifth Five Year Plan is expected to be 4.0 million tonnes.

29.6.3 The estimated urban demand by 1985 is expected to be 12 million tonnes annually. The urban milk demand for these towns with a population of over 50,000 is expected to be 8 million tonnes annually by 1985. The aim should be that the organised sector should capture and command the milk market in these towns, enabling them to become price/quality leaders. The organised sector should, therefore, have an installed capacity to handle about 90 per cent of the urban demand. Therefore, the capacity of these urban plants should be 7.2 million tonnes annually by 1985. Since the processing capacity at present is 2.3 million tonnes, additional facilities would be required to process nearly 5 million tonnes of milk annually or approximately 150 lakh litres of milk per day.

29.6.4 As explained earlier, the production of an additional 22 million tonnes of milk should be concentrated around feeder/balancing

plants with an installed capacity of 30 million litres/day. It is anticipated that by 1976 the installed capacity of feeder/balancing plants would be nearly 5 million litres/day. The additional installed capacity required by 1985 would be 25 million litres/day.

29.6.5 Planning, programming, monitoring, implementation and operation of the 150 dairy complexes, processing of some 14 million tonnes of milk in feeder/balancing dairies and urban milk plants would call for the collection and processing of a large amount of data related to milk production, procurement and enhancement inputs, organisational efficiency, feasibility studies, critical path analysis, demand analysis and computation of price/product mixes etc. It would also need the availability of data 'on real time' basis for the operation of the national milk grid. We note that the NDDB has already undertaken systems development work in these areas and is in the process of obtaining a computer to serve the needs of the dairy industry.

29.6.6 In Chapter 10 on Demand Projections we have indicated that in 2000 AD the estimated requirement of milk would be 49.36 million tonnes comprising 31.81 million tonnes for rural areas and 17.55 million tonnes for urban areas according to low estimates and according to high estimates 64.40 million tonnes covering 42.39 million tonnes for rural areas and 22.01 million tonnes for urban areas. In Chapter 28 on Cattle and Buffaloes we have indicated that total milk production by 2000 AD will be 64.40 million tonnes, if the proposed programmes for livestock development are successfully undertaken and the infrastructure for the provision of inputs and marketing of the surplus milk are developed. Of the 64.40 million tonnes production anticipated in 2000 AD, almost the entire amount will be produced in rural areas and arrangements will have to be made for marketing of 22.01 million tonnes of milk from rural areas to the urban areas. We are not venturing at present, any further estimates of the facilities required by way of infrastructure for collection, processing and distribution of this quantity of milk since it is difficult to visualise the size of demand centres as they will grow at that distance of time from the present. It is also difficult at this stage to visualise the future developments in the field of dairy technology.

7 ADMINISTRATIVE AND INSTITUTIONAL STRUCTURE

29.7.1 For implementation of dairy modernisation, on the scale recommended here, the institutional structure must increase its scope and effectiveness in anticipation of its mounting tasks. The composi-

tion of each institution must reflect the interests of those whom it should serve, with built-in stimuli to ensure social awareness and self-supportive growth.

Evolution of Institutions at National Level

29.7.2 Considerable advances have been made recently in the institutional structure of dairy development. However, if modern dairy industry is to develop as rapidly as required, its institutional structure must grow in anticipation of future needs. Although dairying, as a part of agriculture, is a State subject, the Government of India in the Ministry of Agriculture and Irrigation, plays a pivotal role in dairy development. We recommend that the dairy wing of the Government of India should continue to lay down policies, plan and promote dairy development programmes, monitor their progress and bring around discipline in the industry. We have also recommended later in para 29.7.14 that the provisions relating to the Milk and Milk Products Order should be enforced by the Agriculture Ministry. This will entail additional work. This wing should be strengthened so that it can increase its contribution to dairy development in securing support and acting in a liaison capacity for dairy development institutions *vis-a-vis* other departments of Government and the Planning Commission, strengthening the operations of the law in support of dairy development, building the channels of communication between dairy projects and institutions of research and teaching. The Ministry should not undertake commercial operations and should divest itself of the responsibility for operating the Delhi Milk Scheme.

State Level Institutions

29.7.3 State Governments : In most of the States, several Departments/Directorates are looking after the work of milk production, health coverage, milk procurement and marketing. In some of the States, there are also 3 or 4 separate functionaries such as Directorate of Veterinary Services, Directorate of Animal Husbandry and Directorate of Dairy Development and the State Dairy Development Corporations. This multiplicity of departments apart from increasing the cost and diluting the responsibility has created confusion and inter-departmental rivalries. In some States, problems have increased further as separate Ministers look after these different departments.

29.7.4 The State Governments should set up a unified department to deal with milk production, processing and marketing. Its function should be to assist in the formulation of dairy policies and

to monitor their implementation. Execution of projects and especially operation of dairies, should not be attempted by this department. We have discussed the organised aspects of the department in greater detail in Chapter 62 on Administration.

29.7.5 State Dairy Development Institutions : Many State Governments have already set up State Dairy Development Corporations for implementation of dairy development plans. We note with satisfaction that State Dairy Development Corporations have already been formed in West Bengal, Karnataka, Bihar, Andhra Pradesh, Haryana, Gujarat, Tamil Nadu, Punjab, Madhya Pradesh and Rajasthan. This approach to implementation of dairy development programmes is to be commended. Each such State institution should build up its capacity for project design and development and for coordination of its State milk grid. As each of its dairy projects becomes viable, however, it will be well advised to hive off their operations to the district level milk producers' cooperatives. The district level milk cooperatives could also be federated into a marketing federation as has been done in Gujarat. In such a case, the federation can become the regional link in the national milk grid. On the basis of the experience gained by the Gujarat Federation, the State Governments should consider promotion of such Federation in their States.

The Indian Dairy Corporation/National Dairy Development Board

29.7.6 The formation of the National Dairy Development Board and the Indian Dairy Corporation has been discussed earlier. At present the IDC is responsible for implementation of Operation Flood. The IDC should now be broadened and strengthened so that it can act as a finance house and promotional institution for speeding up the reorganisation of the dairy sector as a whole.

29.7.7 The National Dairy Development Board as mentioned earlier was set up by Government of India in 1965. The NDDB has now developed significant capacities for project planning, processing and implementation. It is now in a position to offer complete facade of services including feasibility studies, execution of dairy projects on consultation/turn-key basis, organisation of milk producer cooperatives, consultancy services in the fields of dairy husbandry, milk processing, marketing and management. It also offers facilities for custom made training programmes for the development of manpower required to manage the various dairy development programmes. Over the years, the NDDB has also attracted in its fold high calibre technical personnel in different disciplines connected with dairy work.

29.7.8 Originally it was intended that NDDB should implement Operation Flood Project. However, because of its constitutional limitations, it was found that this responsibility could not be vested in them, hence the Indian Dairy Corporation was created under the Companies Act. The NDDB and the IDC have a common chairman and many of the Directors of the IDC are also the Members of the National Dairy Development Board. The Board, in fact, has been working as the technical and development wing of the IDC. As we visualise the greater role of IDC in guiding and helping day to day operations in the country on a large scale, even after the completion of the Operation Flood Project, it would be desirable for IDC to have a strong research and development wing of its own. We, therefore, recommend that the NDDB may be merged with the IDC as its research and development wing. The integration of these two institutions is necessary as it would lead to integrated approach, better coordination and economy of the operations. The outstanding success of the NDDB was due to its operational freedom and the competent technical leadership it has enjoyed throughout. We, therefore, recommend that even after merger of the Board with IDC, it should have the same freedom of operation as it has at present.

29.7.9 The dairy industry in the country is still in its formative stage and it has got vast potentialities for expansion. It is generally felt that the success of IDC and the NDDB within this short period has been to a great measure due to the technical leadership that these organisations enjoyed. We would, therefore, recommend that the reorganised IDC should continue to have technically qualified persons as Chairman and Managing Director. The Board of Directors should also be from amongst professionally qualified persons in the field of dairying, animal husbandry, management and finance.

Legal Fiscal Measures

29.7.10 The legal and fiscal measures adopted in the country have considerable effect on development of dairying. The recent imposition of excise duty on milk products such as skim milk powder and table butter has resulted in adversely affecting the efficient and economic year-round supply of milk. We recommend that skim milk powder, unsalted butter and other dairy products used for preparation of reconstituted milk for urban milk supplies may be exempted from imposition of excise duty.

29.7.11 The Factories Act continues to make split-shift working difficult. Most dairies have two clearly defined 4 hour periods each day when their requirement of semi and unskilled labour attains a

peak. If this requirement could be met on a split-shift basis, dairy plants could operate more efficiently and pay their least paid workers better.

29.7.12 The Prevention of Food Adulteration Act controls the quality of milk and products. In practice, it is applied less rigorously to the liquid milk or products handled by the traditional dairy sector. It is applied more rigorously to organised dairies which adopt more stringent quality control procedures. This difference in rigidity in enforcement of the Act encourages a market structure which is inimical to dairy development.

29.7.13 It is recommended that the enforcement of Prevention of Food Adulteration Act be intensified to ensure that consumer confidence in modern dairy products is not eroded by adulterated/imitation products. For example, if margarine is allowed to be coloured yellow, the product may find its way into the market as butter. Such imitation and also the production of so called "vegetable milks" without proper control can erode the consumer confidence in dairy products.

29.7.14 There is no unified control over the location and size of dairy plants, procurement areas are not delineated for dairies nor is any dairy organisation legally obliged to assist milk production enhancement in its procurement area. The Industries Development and Regulation Act originally exempted from licensing projects requiring an investment of up to Rs. 25 lakhs. This exemption level was recently raised to Rs. 1 crore to encourage an increase in productive investment. It was later realised that a dairy factory costing Rs. 1 crore could handle as much as 1,00,000 litres of milk daily and the uncontrolled proliferation of such plants could seriously impinge upon the orderly marketing of milk. The exemption level for dairy projects was, therefore, reduced again to Rs. 25 lakhs. However, even now there exists in some areas a jig-saw puzzle of plants with overlapping procurement requirements. In fact, anarchy still reigns in many procurement areas. No developed country with a significant dairy industry has been able to develop it on this free-for-all basis. A draft Milk and Milk Products Control Order which *inter alia* envisages control of dairy plant construction, delineation of milk-sheds *vis-a-vis* authority for milk procurement, responsibility for increasing milk production etc. is under the consideration of the Government of India in the Ministry of Agriculture and Irrigation. We recommend that Government should expedite the examination of the draft and take steps for early enactment of necessary measures.

8 SUMMARY OF RECOMMENDATIONS

29.8.1 The main recommendations made in this chapter are given below.

1. Corrective measures should be taken to ensure adequate production of milk to meet the market demand and development of efficient systems of movement of milk from production to demand centres. Adequate facilities should be created for conservation of milk during the flush season for utilisation during the lean season. A rational milk pricing policy should be adopted to encourage milk production.

(Paragraph 29.3.6)

2. Techno-economic feasibility studies should be made to explore the possibilities of large scale production of traditional milk food delicacies in manufacturing plants. Similar studies should be undertaken to determine the optimal balance that a dairy organisation has to maintain between processing of fluid milk and manufacture of milk products to make it a profitable commercial enterprise.

(Paragraph 29.3.14)

3. Processes for utilisation of milk by-products should be developed for commercial exploitation. Dairy and Food Research and other Institutes should standardise methods of manufacture of milk food delicacies and undertake research studies for improving the storage life, flavour and taste of various traditional milk food delicacies and their packaging.

(Paragraph 29.3.15)

4. Energetic steps should be taken in milk producing regions to establish strong cooperative organisations of milk producers.

(Paragraph 29.3.21)

5. Chilling centres should be installed by the dairy organisation only when unavoidable.

(Paragraph 29.3.25)

6. A clear-cut policy should be laid down by the Government of India for purchase of marketable surplus skim milk powder for creating an adequate buffer stock of this product.

(Paragraph 29.3.32)

7. Delivery systems with different kinds of milk cans and more particularly with tamper proof sanitary cans should be given trials on a wider scale to determine the convenience and economy of operation of the system and its acceptability to the consumers.

(Paragraph 29.3.54)

8. Detailed techno-economic feasibility studies should be undertaken by large city milk plants for processing, packaging and delivery of milk. This should be done by the plants in collaboration with the

National Dairy Development Board, National Dairy Research Institute and other Institutions with good dairy engineering workshops.

(Paragraph 29.3.55)

9. While planning is done for a city milk supply project, steps should simultaneously be taken to ensure sale of milk in the connected milkshed areas through cooperative organisations.

(Paragraph 29.3.56)

10. Dairy development programmes should keep in view the prospective growth centres in non-milkshed areas for organising milk supply to these regions as necessity arises.

(Paragraph 29.3.56)

11. Consistent with demand-supply situation, a dairy organisation should adopt a pricing policy for milk procurement that would ensure an even supply of milk throughout the year.

(Paragraph 29.3.63)

12. Dairy industry should accept the two-axis pricing policy for milk procurement as this is rationally based on evaluation of both the fat and solids-not-fat content of milk.

(Paragraph 29.3.70)

13. The sale price of milk and its products should be fixed in a manner that would enable the organised dairy industry to pay remunerative price to the milk producers and meet the cost of collection, processing and distribution of milk and milk products. The sale prices should also cover the cost of services rendered in connection with channelising the inputs for milk production, keep a fair margin of profit and yet make the price of the commodities competitive.

(Paragraph 29.3.71)

14. The dairy industry should achieve efficiency in organising service to the milk producers for marketing inputs for milk production enhancement.

(Paragraph 29.3.74)

15. An efficient milk pricing organisation should be set up in each dairy plant and in each State to fix the producer and consumer prices of milk from time to time. An inter-State authority should be established for the same purpose to coordinate the activities of the dairy plants that collect milk from more than one State. These and other recommendations contained in the report of the Milk Pricing Committee (1972) appointed by the Government of India should soon be implemented.

(Paragraph 29.3.79)

16. So long as the private industries do not come in the way of development of cooperative organisation of milk producers they should be allowed to function subject to their providing inputs for

enhancement of milk production in their respective milkshed areas.

(Paragraph 29.4.10)

17. To encourage the milk producers to become shareholders of joint stock companies working in the field of dairying, the companies should keep a stipulated minimum percentage of shares reserved for the milk producers. The companies should also have an effective representation of the milk producers on the Board of Management so that the interests of the producers are fully safeguarded.

(Paragraph 29.4.11)

18. As dairy development programmes can best be organised by the cooperatives of the milk producers, the producers should first be organised into Primary/Village level cooperative societies. Persons not involved in milk production or those associated with private milk business should not be allowed membership of these societies.

(Paragraphs 29.4.16 and 29.4.17)

19. The primary milk producers' societies should be federated into a district level milk producers' union.

(Paragraphs 29.4.18 and 29.4.19)

20. The responsibility of forming the Primary Societies and the District Unions should be entrusted to a team of specially trained persons with experience in the field of cooperative organisation.

(Paragraph 29.4.20)

21. In the States where complete cooperative structure of milk producers' unions does not exist but State Dairy Corporations have been formed, the Corporations should take up the functions of the Unions that have not yet come into existence strictly as an interim measure. State Dairy Corporations should promote the formation of the complete structure of cooperative unions as early as possible and hand over the operations and facilities of the organisation to the unions as soon as those are established.

(Paragraph 29.4.22)

22. The problems now being encountered by the dairy equipment manufacturing firms should be examined by the Government in collaboration with the concerned interested parties to find out satisfactory solutions.

(Paragraph 29.5.2)

23. The possibility of indigenous manufacture of the dairy equipment now being imported should be explored.

(Paragraph 29.5.3)

24. The Government of India should negotiate with the Governments of foreign countries to explore the possibilities for the supply and installation of complete dairy plants on turn-key basis which should include advisory service and training of personnel.

(Paragraph 29.5.4)

25. The Indian Dairy Corporation should be encouraged to enter the field of manufacture of dairy and allied equipment.

(Paragraph 29.5.5)

26. The dairy development wing of the Union Ministry of Agriculture and Irrigation should be adequately strengthened to equip itself properly to meet the needs of increasing dairy development in the country. The Ministry should not undertake commercial operation and should absolve itself of the responsibility for the operation of the Delhi Milk Scheme.

(Paragraph 29.7.2)

27. The State Governments should set up a unified department to deal with production, processing and marketing of milk. Operation of dairy plants should not be undertaken by Government departments.

(Paragraph 29.7.4)

28. The State Dairy Development Corporations should build up the capacity for project designing and development and for coordinating the functioning of the respective State milk grids.

(Paragraph 29.7.5)

29. The Indian Dairy Corporation should be strengthened so that it can function as a finance house and a promotional institution for speeding up modernisation of the organised dairy sector.

(Paragraph 29.7.6)

30. The National Dairy Development Board should be merged with the Indian Dairy Corporation to form its research and development wing. This wing should continue to enjoy the operational flexibilities and facilities which are being enjoyed by the Board at present.

(Paragraph 29.7.8)

31. The reorganised Indian Dairy Corporation should continue to have technically qualified Chairman and Managing Director. The Board of Directors should also be constituted with persons professionally qualified in dairying, animal husbandry, management and finance.

(Paragraph 29.7.9)

32. Enforcement of Prevention of Food Adulteration Act should be intensified to ensure that consumer confidence in milk and milk products obtained from organised dairy plants is not eroded by adulterated/imitation products.

(Paragraph 29.7.13)

33. A draft of Milk and Milk Products Control Order is under consideration of the Union Ministry of Agriculture and Irrigation. The draft should be scrutinised expeditiously by the Ministry for early enactment of necessary measures.

(Paragraph 29.7.14)

APPENDIX 29.1

(Paragraph 29.3.7)

Pattern of Milk Utilisation in India

Year	Per cent of total used for									
	Milk as be- verage	Ghee	Butter	Curd	Khoa	Cream	Ice cream	Others		
1951	39.3	39.3	6.0	8.8	4.4	0.5	0.7	0.4		
1956	39.1	40.0	6.1	6.8	4.4	0.5	0.7	0.4		
1961	45.2	31.8	6.4	8.1	4.7	1.9	0.7	1.2		
1966	44.5	32.7	6.3	7.8	4.9	1.9	0.7	1.2		

APPENDIX 29.2

(Paragraph 29.3.70)

Two-Axis Pricing of Milk

Value of fat—Rs. 15.00 per kg.

Value of solids-not-fat—Rs. 10.00 per kg.

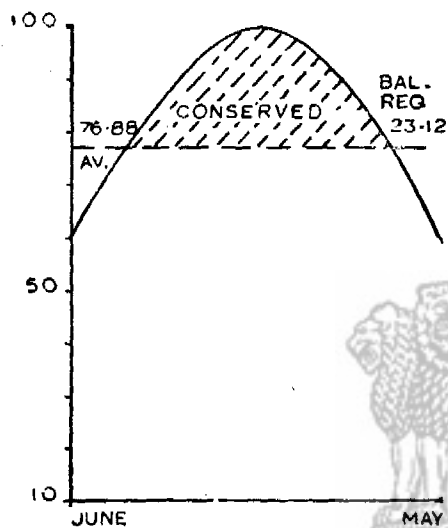
Fat percen- tage	Fat value	SNF						
		percentage :	8.5	8.6	8.7	8.8	8.9	9.0
		SNF value:	85.0	86.0	87.0	88.0	89.0	90.0
4.0	60		145	146	147	148	149	150
4.2	63		148	149	150	151	152	153
4.4	66		151	152	153	154	155	156
4.6	69		154	155	156	157	158	159
4.8	72		157	158	159	160	161	162
5.0	75		160	161	162	163	164	165
5.2	78		163	164	165	166	167	168
5.4	81		166	167	168	169	170	171
5.6	84		169	170	171	172	173	174
5.8	87		172	173	174	175	176	177
6.0	90		175	176	177	178	179	180
6.2	93		178	179	180	181	182	183
6.4	96		181	182	183	184	185	186
6.6	99		184	185	186	187	188	189
6.8	102		187	188	189	190	191	192
7.0	105		190	191	192	193	194	195

Note : This is only an example to illustrate the principle of two-axis pricing. In actual practice, custom made reckoner would need to be worked out for different seasons and according to local prices for fat and solids-not-fat.

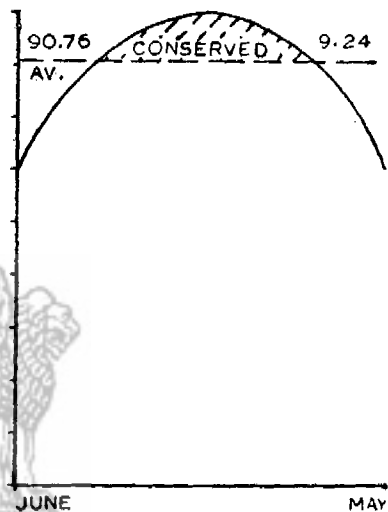
APPENDIX 29.3

PRICING EFFECTS ON PROCUREMENT AND
SEASONAL DAIRY PLANT UTILISATION (PARAGRAPH 29.3.76)

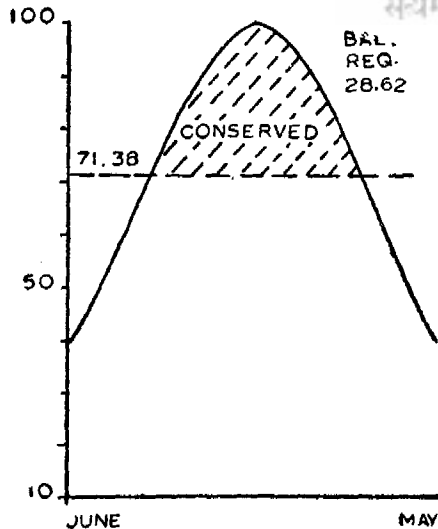
A-1: COW & BUFFALO HERD,
NORMAL PROCUREMENT



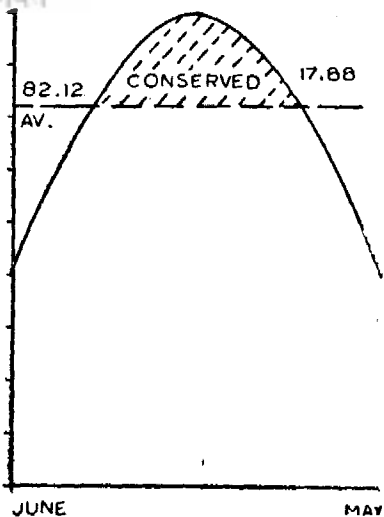
A-2: COW & BUFFALO HERD,
PROCUREMENT WITH SEASONAL
PREMIUM



B-1: BUFFALOES ONLY,
NORMAL PROCUREMENT



B-2: BUFFALOES ONLY,
PROCUREMENT WITH SEASONAL
PREMIUM



SHEEP AND GOATS

1 SHEEP

Introduction

30.1.1 India possesses 40 million sheep (1972)¹ and ranks sixth among the countries of the world in sheep population.² No reliable data regarding the contribution of sheep to the national income are available. However, according to a rough estimate, it may be around Rs. 140 crores per annum. This figure is based on the annual (1972) production of about 34.5 million kg wool, 101 million kg mutton, 14.6 million pieces of skins and the value of manure and by-products like casings, offals etc.

30.1.2 Sheep farming provides employment opportunities to a large section of the population, particularly to the weaker sections of the community in hilly, drought prone and desert areas. As stated in paragraph 3.4 of the Interim Report on Poultry, Sheep and Pig Production through Small and Marginal Farmers and Agricultural Labourers for Supplementing their Income (hereinafter referred to as Interim Report on Poultry, Sheep and Pig Production), sheep rearing can be introduced as a subsidiary occupation on a mixed farming basis in all agroclimatic regions excepting heavy rainfall areas. Because of their ability to graze very close to the roots of herbage, sheep can utilise sparse and low set vegetation on which other species of livestock may not be able to subsist. Sheep droppings improve the fertility of soil considerably and penning of sheep in harvested fields (sheep folding) brings in additional income to the flock owners. Since sheep rearing does not require any large investment in buildings and equipment, it offers good scope for exploitation by the small and marginal farmers and agricultural labourers.

30.1.3 The average production of wool and mutton of indigenous sheep is, however, very low. For instance, a Rajasthani sheep on an average produces annually about 1.4 kg wool compared to 5 to 6 kg

¹ Eleventh All-India Livestock Census—1972 (Provisional).

² FAO Production Year Book, 1972 Vol. 26, 189—191.

of fine wool in countries like Australia, New Zealand and United Kingdom.¹ The quality of wool from the indigenous sheep is inferior because of higher average fibre diameter, presence of medullated especially kempy fibres and a very large heterogeneity both in fibre diameter and staple length. Even some of the fine and combsworthy Indian wools are harsh to feel, the major portion being of the coarse carpet quality. The Indian carpet wool also lacks lustre but strong alkali treatment can provide it. The autumn shorn wool in north western region, however, gets brittle and stained when so treated. Brittleness makes these carpets prone to shedding especially when vacuum cleaned. The canary colouration results in uneven dyeing and subsequent differential fading leading to skitriness. The carpets made out of such wool, therefore, fetch 24 to 30 per cent of price of Iranian, Afghanistani and Chinese carpets in foreign markets.² Production of mutton of indigenous sheep is also low in comparison with that of exotic breeds. Rams and ewes of indigenous breeds on an average weigh between 27 and 36 kg and between 18 and 27 kg respectively, while purebred rams of many exotic breeds weigh between 60 and 113 kg and ewes between 54 and 74 kg.¹ The dressing percentage in Indian breeds excepting in Mandya is also lower than in most exotic mutton breeds. The low production of mutton and wool from the indigenous sheep is mainly due to the economic backwardness of shepherds, nonadoption of scientific methods of breeding, feeding and management and extremely poor grazing resources.

Regional Distribution of Sheep

30.1.4 There is a wide variation in the types of sheep found in different parts of the country. Taking into consideration the varying agroclimatic conditions and the types of sheep found in different zones, the following four regions can be distinguished:

- (i) The northern temperate region comprising Jammu and Kashmir, Himachal Pradesh, and hilly parts of Uttar Pradesh has approximately 3.09 million sheep producing medium to fine wool. The region carries 7.6 per cent of the total sheep population and produces 2.06 million kg or 6 per cent of the total wool produced in the country. The important breeds in this region are Gurez, Karnah, Bhakarwal, Gaddi, Kashmir Valley and Rampur Bushair. Quite a sizeable proportion of the sheep population in this region especially in Jammu and Kashmir

¹ Daroga Singh, Rajagopalan, M. and Maini, J. S. Monograph on estimation of wool production, Indian Council of Agricultural Research, New Delhi.

² Acharya R. M., 1974. Improving Carpet Wool Production and Quality. Indian Farming 24 : 29.

consists of crosses between the indigenous and exotic fine wool breeds.

- (ii) The north western region comprising Punjab, Haryana, plains of Uttar Pradesh, Rajasthan, Gujarat and Madhya Pradesh has 13.1 million sheep producing mostly coarse carpet quality wool, except Chokla and Pattanwadi which produce medium to fine quality carpet/medium apparel wool. This region is mostly arid and semi-arid and carries about 32.4 per cent of the sheep population which contributes 22.1 million kg or 64 per cent of the total wool. Important sheep breeds of this region are Chokla, Nali, Magra, Pugal, Marwari, Jaisalmeri, Malpura, Sonadi, Lohi, Maunjal, Muzzafaranagari, Pattanwadi (Kutchi) and Jalauni.
- (iii) The southern peninsular region comprising Maharashtra, Andhra Pradesh, Karnataka and Tamil Nadu has 21 million or 52 per cent of the sheep of which 10 to 12 million produce no wool and the rest produce coarse, hairy and coloured fleeces. This region produces 9.68 million kg or 28 per cent of the total wool and has breeds like Deccani/Bellary, Nallore, Mandya, Mecheri, Ramnad, Madras Red, Nilgiri, Coimbatore, Hassan and Trichi Black. Of these Deccani/Bellary, Mandya and Coimbatore produce extremely coarse and hairy fleece. Other breeds except Nilgiri do not produce any wool and are primarily used for meat production. The Nilgiri which has been evolved by crossing indigenous hairy breeds with exotic breeds (Cape Merino, South Down, Chevoit etc.) produces fine wool.
- (iv) The eastern region comprising Bihar, West Bengal, Orissa, Assam and other eastern states has 3.2 million sheep mostly maintained for meat. The region carries 8 per cent of the total sheep population and produces 0.64 million kg or 2 per cent of the total wool. This region has no distinct breed of its own except in case of Bihar where Shahbadi and Chotta Nagpuri breeds are found. The sheep in this region are of meat type and produce small quantity of wool which is extremely coarse and hairy except in Arunachal Pradesh where a small number of better wool quality sheep are available.

Sheep Husbandry Practices

30.1.5 Sheep raising is mainly in the hands of the weaker sections

of the community which either do not possess land or their landholdings are so small that crop cultivation does not provide remunerative employment all the year round. Further, in the major sheep rearing areas especially in north western districts of Rajasthan grazing and stock watering resources are available only for a few months in a year, compelling shepherds to lead a nomadic life. As stated in paragraph 9.10 of the Interim Report on Desert Development, the system of constant migration is one of the main reasons for the high percentage of illiteracy among these sections of the people. Even children of the family have no chances of education because they are also constantly on the move and are employed by their family for grazing the sheep flocks. Due to lack of education these sheep owners are not able to appreciate and adopt improved sheep husbandry practices brought to them by extension workers. Sheep husbandry has thus remained in a neglected state. Migration and grazing practices have an impact on the present status of sheep husbandry in the country.

30.1.6 Migration of flocks : In the northern hill region, migration of sheep usually starts in April-May and it takes about a month for the flocks to reach the alpine pastures. The flocks graze on these pastures for about 5 to 6 months and then start returning to the foothills by September-October and reach the destination by November. The time taken to reach the alpine pastures largely depends upon weather conditions and the vegetation available on the route of migration. In the hill areas, one or two members of the family go with the flock during migration but the rest stay behind to look after agricultural operations. The economic condition of shepherds in this region is better than that of their counterparts in the plains. As mentioned in paragraphs 9.7, 9.8 & 9.9 of the Interim Report on Desert Development, a fairly large percentage of sheep in Rajasthan is maintained on migratory basis. According to an estimate about 1.5 million sheep migrate from the State every year and out of this about 0.6 million sheep are on migration all the year round¹. Sheep migration is a regular practice with the sheep breeders of the western arid districts of Jaisalmer, Barmer, Jodhpur, Pali, Jalore, Nagaur and Bikaner. It is understood that prior to Partition, sheep from Jaisalmer and Barmer districts used to migrate to the canal areas of Sind during the months of March to June while the sheep from the eastern areas used to migrate towards further east or southwards to the bordering areas in the States of Uttar Pradesh, Madhya Pradesh and Gujarat. Sheep breeders from the districts of Jaisalmer, Barmer and Bikaner and parts of Jodhpur practise temporary migration extending over periods of 6 to 9 months. The flock owners usually start migration with their sheep after Diwali festi-

¹ Sapre M.V. Migration of Sheep in Rajasthan. (Mimeo) Department of Sheep & Wool, Rajasthan.

val in November. Sheep flocks excepting those from Barmer and Jaisalmer districts usually migrate towards the south to Madhya Pradesh taking different routes and finally reach Nagda which is a central place for sale of wool. Sheep flocks also move towards east to Uttar Pradesh along the Chambal and Yamuna river belts. It has been estimated that about 0.2 to 0.3 million sheep from Jaisalmer and Barmer and parts of Jodhpur and Jalore migrate towards Gujarat and the breeders arrange for the sale of wool at Deesa in Gujarat. As the routes towards Madhya Pradesh are new and quite unfamiliar to the sheep breeders of Jaisalmer and Barmer they do not migrate long distances except under very acute conditions of drought and scarcity of fodder. This may perhaps be one of the reasons for heavy losses of sheep sustained by the sheep breeders of these districts during continuous drought periods. Sheep flocks from parts of Bikaner, Churu and Sikar districts usually migrate towards north to areas in Haryana, Punjab and Delhi. Sheep owners of Nagaur district practise migration all the year round because of heavy pressure on land and they depend on the forest areas in Rajasthan and Madhya Pradesh for the grazing of their sheep. Maintaining sheep on migration through most part of the year does not permit the sheep owners to obtain adequate income from their flocks. With such a system of constant movement of sheep over long distances with uncertain grazing and stock watering facilities, the sheep owners are unable to adopt scientific methods of breeding for genetic improvement of stock. Shearing of sheep in distant places and sale of wool at far away markets do not give them any chance for organised collection, processing and marketing of wool and the sheep breeders are unable to bargain for a remunerative price. These difficulties could be alleviated if the State Animal Husbandry/Sheep and Wool Departments set up service centres on the migration routes.

30.1.7 Grazing : In the north temperate region sheep are grazed on alpine pastures during most of the summer months; in autumn and winter seasons, they are grazed on harvested fields in the lower ranges of the hills and reserve forests. Usually 7 to 8 hours of grazing is practised in a day. However, grazing in winter does not meet the nutritional requirement especially for the animals in advanced pregnancy. This reduces lambing percentage and results in poor lamb survival and growth due to low mothering ability. Serious efforts are, therefore, called for in improving grazing/fodder resources during the winter. This is possible through raising a short term fodder crop after rice. It is estimated that even at present about 13 per cent of the flocks are hand fed on some grains, conserved fodder or green leaves during winter. In the north western region, sheep are grazed on uncultivated lands during monsoon months. During post-monsoon period when

kharif crops are harvested, they are grazed on stubbles. In November and December non-migratory flocks are mostly grazed on uncultivated lands, whereas migratory flocks are grazed on harvested fields and in reserve forests on their migration routes. Top feeding by lopping tree branches and the feeding of pods are common. During extreme summer months, the flocks are grazed in the cool hours of the day and rested during the noon hours. In the peninsular region, there is hardly any migration of flocks. The flock size in this region is generally small and the sheep are mostly grazed on stubbles in the harvested fields or in forest or hilly areas. The sheep have thus to subsist at present mostly on stubble, tree loppings and grasses in denuded lands all over the country except in northern hill region where during summer they graze on relatively better pastures in the alpine region. Almost no attention has so far been paid to improve grasslands and to make provision for supply of drinking water to the flocks.

30.1.8 Penning and housing : In the north temperate region after the flocks return from the alpine pastures, 80 per cent of the flockmen pen their sheep in the open near the houses, 18 per cent along with other animals and 2 per cent on the ground floor of their houses. In Rajasthan, 59 per cent of the flocks are penned in open fields away from the houses, and the rest in *kutchha* courtyards near the houses. In the peninsular region specially in Andhra Pradesh, 41 per cent of the flocks are penned in enclosures near the houses and the rest in the open fields¹. Sheep normally do not require elaborate housing facilities but provision of suitable shelter particularly for young lambs, pregnant ewes and breeding rams will definitely increase productivity and reduce losses due to mortality. It is, therefore, necessary to provide cheap houses with thatched roofs made of locally available material and thorny fences. In areas normally experiencing extreme cold or hot winds, some protection against the winds should also be provided.

Economics of Sheep Rearing

30.1.9 Sheep rearing is extremely important in the rural economy of a number of States. But very little information on the economics of sheep rearing in different agroclimatic regions is available at present. The Central Sheep and Wool Research Institute (CSWRI) conducted a limited survey in 1972 on the economics of sheep rearing in Chokla and Nali tracts of Rajasthan². These studies indicated an average

¹ Sample survey for estimation of wool production, 1959—64. Institute of Agricultural Research Statistics, ICAR, New Delhi.

² Acharya, R.M. and Saxena, S.K. 1972. Review of Research in Sheep Production. Mimeo, Central Sheep and Wool Research Institute, Avikanagar.

annual income of Rs. 3,881/- for Chokla and Rs. 5,642/- for Nali, with a flock size of 100 breedable ewes, attendant rams and their followers. The major difference in the economic returns of the two breeds was due to differences in wool yield and the number of lambs born and their survival rate. It was observed at the CSWRI Farm that the Rambouillet \times Chokla halfbreeds provided 25 per cent more economic returns from the sale of wool as compared with the Chokla breed. We expect that improvement in production and quality of wool due to crossbreeding, provision of a better health cover and adequate supply of feed and fodder will ensure higher returns. However, no reliable data are available on the economics of supplemental feeding of sheep during growing stages, breeding seasons, later part of gestation, lactation, etc. In our opinion, it is necessary for the purposes of planning sheep development programmes to have detailed information on these aspects. We, therefore, recommend that the Indian Council of Agricultural Research (ICAR) and agricultural universities should initiate without delay studies in this direction.

Population Estimates and Trends

30.1.10 The population of sheep according to the quinquennial censuses for 1919-20, 1924-25, 1929-30, 1934-35, 1939-40 and 1945 was 22.60, 23.13, 25.22, 22.13, 25.08 and 19.97 million respectively. These figures show a steady increase in sheep population during the period 1919-20 to 1929-30, but a decline during 1934-35 and another in 1945. These declines were probably due to indiscriminate slaughter of sheep to meet demands of food during scarcity years preceding 1934-35 census, and during the second world war preceding 1945 census.

30.1.11 After Independence the distribution of sheep population in the different States/Union Territories during the period 1951 to 1972 is shown in Table 30.1.

TABLE 30.1

Distribution of Sheep Population in India

(in '000)

Sl. No.	State	1951	1956	1961	1966	1972
1	2	3	4	5	6	7
1.	Andhra Pradesh	10,193	7,846	8,363	8,004	8,343
2.	Assam	33	169	54	49	25
3.	Bihar	908	1,051	1,156	1,247	983
4.	Gujarat			1,481	1,652	1,722
5.	Maharashtra	3,645	3,715	2,093	2,205	2,128

1	2	3	4	5	6	7
6. Haryana	}				516	459
7. Punjab		846	1,230	925	444	436
8. Himachal Pradesh	.	627	697	662	1,049	1,040
9. Jammu & Kashmir	.	979	1,465	1,163	1,152	1,072
10. Karnataka	.	4,346	4,060	4,765	4,748	4,827
11. Kerala	.	432	98	24	12	10
12. Madhya Pradesh	.	687	901	1,009	1,016	1,009
13. Manipur	.	*	1	4	9	2
14. Meghalaya	21	18
15. Nagaland	*	*
16. Orissa	.	682	1,079	994	1,182	1,369
17. Rajasthan	.	5,393	7,373	7,360	8,806	8,556
18. Tamil Nadu	.	7,926	7,042	7,160	6,621	5,615
19. Tripura	.	1	7	3	2	2
20. Uttar Pradesh	.	1,636	1,906	2,462	2,623	1,956
21. West Bengal	.	622	611	535	639	808
22. Union Territories	.	7	8	10	18	15
all-India	.	38,962	39,259	40,223	42,015	40,395

Source : All India Livestock Census—Eighth to Eleventh.
Population below 500 is indicated by “*”

It will be observed from Table 30.1 that there has been a progressive increase in sheep population during the period 1951 to 1966, but the 1972 census shows a small decrease in the all-India figure, the States contributing most to this decrease are Tamil Nadu, Uttar Pradesh and Bihar. A much smaller decline was also observed in the important sheep rearing States of Rajasthan, Jammu & Kashmir and Himachal Pradesh. It is however, difficult to explain the reasons for this decline. It is necessary to point out that the censuses do not give breakup of different categories like ewes, rams and young of the exotic, crossbred and indigenous stock. Since these data are required for analysing the trends in sheep population and for determining the progress of the sheep development programmes, we recommend that from the next census onwards these breakup figures should be collected on a sample basis.

Wool Estimates

30.1.12 Reliable estimates on production of wool in the country are lacking. Those that have been published (Table 30.2) by various agencies are mainly based on the total sheep population and ad-hoc estimates of average wool yield.

TABLE 30.2

Sheep Population and Estimated Wool Production in India

Year	Sheep population based on live-stock census (millions)	Greasy wool production (million kg)
1951	38.96	27.50*
1956	39.25	31.00* (27.54)**
1961	40.22	32.70* (28.74)**
1966	42.01	35.50* (32.72)**
1972	40.39	34.48† (35.45)**

Source: * Wools and Woollens of India—Handbook of Statistics and Government Notifications—Published by the Indian Woollen Mills' Federation, Churchgate Chambers, Bombay-20. (1971).

** Figures in parentheses are those reported by the Directorate of Marketing and Inspection Ministry of Agriculture and Irrigation.

† Projected from 1966 figure.

The data given in Table 30.2 show that there was an increase of about 8 million kg in wool production from 1951 to 1966. This increase may be attributed mainly to the progressive rise in sheep population and perhaps only a very small fraction to an increase in wool yield as a result of sheep development programmes taken up under the Five Year Plans.

30.1.13 In addition to the two sources mentioned in Table 30.2 attempts have also been made by other agencies to assess the production of wool in the country at different points of time. The IARS conducted sample surveys in 5 States and by projecting the regional estimates for the whole country on certain assumptions, estimated that the total annual production of greasy wool in 1966 was 28,420 tonnes (28.42 million kg).¹ The Commonwealth Secretariat estimated that production of greasy wool in India during the year 1972-73 was 33 million kg.² In the draft Fifth Five Year Plan the production of wool in 1973-74 was estimated at 30.10 million kg and this figure is reported to be based on the information obtained from the various State Departments of Animal Husbandry/Sheep and Wool.³ It is estimated that 57 per cent of the total wool produced indigenously is of the carpet quality and 43 per cent is of the apparel quality. Of the 43 per cent apparel quality 15 per cent is of the combing type and 28 per cent is used for woollen apparel.

30.1.14 Information on wool production on a complete enumeration

1 Sample survey for estimates of wool production. Reports of the Institute of Agricultural Research Statistics (ICAR) for the years 1959-63 : New Delhi.

2 The Indian Wool Textile Industry, World Wool Digest, 1973, 23.

3 Draft Fifth Five Year Plan, Planning Commission, Government of India, New Delhi.

basis would of course be the most reliable estimate on the production of different categories of wool and the total production in the country. Such a procedure, however, is not only very costly but also difficult. The IARS had, therefore, taken recourse to the modern techniques of random sample survey while undertaking studies on sheep rearing practices and production of wool. The IARS conducted surveys in Gujarat, Rajasthan, Mysore (now Karnataka), Himachal Pradesh and Andhra Pradesh. We recommend that the sampling design formulated by the IARS should be used by the States for the estimation of wool production. The Ministry of Agriculture and Irrigation is contemplating to carry out under the Fifth Plan systematic sample surveys simultaneously in all the States for estimation of production of livestock products, such as milk, eggs, meat, wool etc. One particular product would be chosen for a particular year. This procedure should be continued on a regular basis and the estimation of wool production should be taken up in a particular year in all the states.

Progress of Sheep Development

30.1.15 The East India Company initiated programmes for crossing indigenous sheep with exotic fine wool breeds to improve the quality and quantity of wool for feeding the woollen mills in the United Kingdom. These were probably the earliest attempts in this direction. No definite information regarding the crossbreeding programmes, the exotic breeds used and the number of sheep imported is, however, available. A few old records indicate that some success was achieved in crossbreeding work, particularly with Cape Merino, around Poona where 4,000 to 5,000 crossbred sheep were raised. The crossbred sheep produced wool superior in quality and more than four times in quantity than the indigenous sheep. However, the good work done faded away within a period of 10 years as the programme could not be continued. The Royal Commission on Agriculture (1928) attributed this to lack of organisational setup. Some trials were undertaken at the Amrit Mahal Farm in the former Mysore State but they also failed. It appears that some of these sheep were taken to Nilgiri hills and are still available there in small numbers producing fine quality wool. A number of sporadic crossbreeding trials were also undertaken in the first half of the nineteenth century in Punjab, Bengal and Madras. Southdown and Cape Merino were the exotic breeds used in these trials. The experience was that the Cape Merino crosses thrived better than those from the British breeds.

30.1.16 In the first decade of the twentieth century programmes of crossbreeding the local and Bikaneri breeds with Merino and Romney

Marsh rams were undertaken at a number of places in United Provinces, both in plain and hill areas. Although grading of local and Bikaneri sheep with exotic rams continued upto the second generation, no consistent results were achieved and the experimental work was discontinued for want of financial provision and lack of organisation. Simultaneously, breeding of Bikaneri sheep with Merino was undertaken at the Government Livestock Farm, Hissar and continued over a number of years resulting in the evolution of a new breed, Hissardale. Although there is no authentic record regarding the level of Merino inheritance in the crossbreds interbred to create Hissardale, it is believed that it was around 75 per cent. A small flock of this breed is being maintained at the Government Livestock Farm, Hissar and appears to be well adapted to the extreme heat and severe dry cold climate of north Indian plains. We are informed that there has been some deterioration in the performance over the years which could possibly be due to inbreeding resulting from small effective population size and little selection. Immediate efforts to improve this breed through outcrossing this flock with some fine wool breeds, e.g. Rambouillet/Merino followed by selection for greasy fleece production and fleece quality are called for. The superior rams of the breed should be used for upgrading indigenous breeds in the north-western arid and semi-arid plains for improving wool quality.

30.1.17 With the constitution of the Imperial (now Indian) Council of Agricultural Research (ICAR) a number of pilot experiments for breeding superior sheep were undertaken from 1938 to 1949 in different parts of the country. With the experience gained it was decided that the improvement of indigenous breeds in the plains through selection should receive priority and that crossbreeding should be restricted to the temperate Himalayan region and to sheep rearing areas of the western part of Deccan plateau. In 1952 a comprehensive plan for sheep development on regional basis to deal with the problems of evolving superior breeds and for studying different aspects of sheep husbandry was prepared by the ICAR. The establishment of a fullfledged centre for conducting research on sheep and wool in each of the three regions, viz., the temperate Himalayan region, the dry Northern plains and the Southern region was also sponsored by the ICAR. Sheep breeding farms were established at Banihal and Riasi in Kashmir, Gwal-dom in Uttar Pradesh, Sarhan in Himachal Pradesh. Darjeeling in West Bengal, Jorbir (Bikaner) in Rajasthan, Pattan in Gujarat, Poona in Maharashtra, Nilgiris (Ootacamund) in Madras and Gaya in Bihar. The breeding programmes included selective breeding within the indigenous breeds or crossing them with exotic fine wool breeds.

30.1.18 During the First Plan, crossbreeding trials on indigenous

sheep with different exotic breeds were carried out. Regional centres were set up in Uttar Pradesh hills, Rajasthan and Deccan Plateau. During the Second Plan three sheep breeding farms were established for production of stud breeding rams, and sheep and wool extension centres were started in some States for carrying out improvement in the rural areas through the supply of superior stud rams. A wool testing laboratory was set up at each farm to help in the assessment of wool improvement through the sheep and wool extension activity. During the Third Plan, the existing sheep breeding farms were strengthened. A large scale sheep shearing wool grading and marketing programme was initiated in Rajasthan with the assistance of Food and Agriculture Organisation of the United Nations. Another significant achievement was the establishment of the Central Sheep and Wool Research Institute in 1962. At the beginning of the Fourth Plan there were 84 sheep breeding farms, 602 sheep and wool extension centres and 52 supplementary sheep breeding centres in operation in the entire country.

30.1.19 The *ad hoc* Sheep Breeding Policy Committee which was constituted by the Government of India in 1970 had suggested that in order to meet the shortage of stud rams, 20,000 exotic sheep of fine wool breeds for producing breeding rams should be imported. Besides, an equal number of good quality stud rams of indigenous breeds should be produced.¹ For achieving this objective, a Central (Indo-Australian) Sheep Breeding Farm was set up at Hissar during the Fourth Plan with a foundation stock consisting of 3,000 ewes and 300 rams of Corriedale breed. We have been informed that the Farm has now a strength of about 8,000 Corriedale sheep. Two large sheep breeding farms were also set up in the private sector, one in Maharashtra and the other in Gujarat for producing purebred and cross-bred rams. Further, the Government of India initiated action to set up large sheep breeding farms one each in Jammu and Kashmir, Rajasthan, Andhra Pradesh, Karnataka, Madhya Pradesh and Bihar during the Fourth Plan. We are informed that most of these farms are in early stages of development as they were started in the later part of the Fourth Plan. Since these farms are to play a very important role in sheep development programmes through the supply of superior germplasm, every effort should be made to fully develop them within the shortest possible time.

Experience with Exotic Breeds

30.1.20 The importation of exotic sheep started as early as the

¹ Report of the *Ad hoc* Committee on the Sheep Breeding Policy, Ministry of Food & Agriculture, Community Development and Cooperation (Department of Agriculture), 1970.

beginning of the 19th century. A definite record of breeds or number of sheep imported in early 19th century is not available. However, most of these imports were extremely small in number and imported animals were primarily used for crossbreeding with indigenous breeds for improving their wool yield and quality. There are records of importation of Southdown and Cape Merinos during this period. In the earlier part of the 20th century, importation of Merino and Romney Marsh was made in United Provinces. Merinos were also imported for Punjab and maintained at the Government Livestock Farm, Hissar. Sporadic importation of Merino sheep was also effected in Mysore (now Karnataka) State. Five rams and 10 ewes of Merino from South Africa were imported in 1938 for the Sheep Breeding Research Station, Poona. These did not survive for more than 5 years apparently for lack of nutrition. In 1952 a small flock of Merino comprising 5 rams and 10 ewes was imported by Uttar Pradesh Government for their Sheep Breeding Research Station, Pippalkoti. In 1940, importation of rams of Cheviot, Border Leicester, Weinsleydale from Britain and Merinos from Australia was made. The British breeds did not perform well. In 1951 import of one Delaine Merino ram and 10 Rambouillet sheep was effected. No serious problems in the maintenance of the exotic breeds were faced in Jammu and Kashmir. Since 1953-54 there has been continuous importation of exotic breeds like Corriedale, Border Leicester, Polworth and Rambouillet in Uttar Pradesh. The Corriedales and Border Leicester were imported only in 1953 whereas Polworth and Rambouillet were imported over a number of years. We have been informed that the Corriedales and Border Leicester did not fair well whereas the Polworth and Rambouillet performed satisfactorily. In 1964, a flock of 300 ewes and 100 rams of Rambouillet breed was imported for the Central Sheep and Wool Research Institute (CSWRI) and in 1968 a flock of 26 rams, 90 ewes and 71 lambs of Corriedale was imported for the CSWRI Substation at Mannavanur. Since 1969 there has been large scale importation of Corriedales from Australia for Andhra Pradesh, Himachal Pradesh, Jammu & Kashmir and for the Central Sheep Breeding Farm, Hissar. Some importation of polled Dorset, Southdown and Dorset Down was also made for Mysore (now Karnataka). Rambouillet sheep for the States of Jammu and Kashmir, Himachal Pradesh, Maharashtra, Mysore (now Karnataka), Uttar Pradesh and Rajasthan and Russian Merinos for the States of Jammu and Kashmir, Himachal Pradesh, Rajasthan, Gujarat, Tamil Nadu were also imported during the last few years.

30.1.21 No critical data on the performance of the exotic breeds in various agroclimatic conditions of the country have been maintained. It, however, appears that most of these exotic breeds have done

fairly well in dry cool climate and their performance has been extremely poor in hot humid and even in hot arid climate. The experience gained so far in the maintenance of exotic breeds under the Indian conditions has shown that cool dry climate, assured fodder supply, adequate grazing land, efficient health cover and suitable housing are essential for their survival and satisfactory performance. It has also been found necessary that the sheep to be imported should come from the regions having more or less the same type of climate that prevails in the areas where they are to be stationed in the country. Further, it should be ensured that the sheep for import are selected from as large a number of flocks as possible to ensure greater genetic variability.

Requirement of Wool

30.1.22 Fine wool : According to the Textiles Commissioner, Bombay (Ministry of Foreign Trade), the present annual requirements of the worsted sector and the Defence is of the order of 8.90 million kg of scoured wool and this is expected to remain more or less at the same level in the near future. Considering the total installed capacity of 2.04 lakh spindles in worsted sector and 1.33 lakh spindles proposed to be installed in the Fifth Plan period, the requirement of wool in worsted sector on two-shift basis is around 38 million kg of scoured or approximately 76 million kg of greasy wool. The present availability of combing quality wool from internal sources is only about 3.5 million kg (scoured).¹ Thus, the estimated gap between the requirement of the Indian Woollen Industry and the availability from internal sources is 34.5 million kg of fine wool on scoured basis. However, the estimated gap to meet the internal requirement of scoured fine wool is only 5.40 million kg.

30.1.23 Carpet wool : Considering the present installed capacity and the expansion anticipated in the near future, the requirement of wool for the woollen and carpet sectors is estimated as 21.5 million kg scoured wool on two-shift basis or 36 million kg greasy wool. The position with regard to availability of carpet wool is also not satisfactory. Further, there is a great scope for increasing the export of carpet wool and carpets. The carpet industry is contemplating the installation of Mackey type tufted carpet plants and when this is done, the requirement of carpet wool would increase considerably. The Khadi Industries and Cottage Industry Sectors would require 8 million kg wool. Some of the requirements of the Khadi and Cottage Industries are met

¹ Preliminary Report of the Special Sub-Group on Wool Production of National Committee on Science and Technology, 1974.

from tops made available from the organised sector.

30.1.24 Breeding for fine wool production : Improvement in fine wool production can be brought through selection for fleece weight and fleece quality, the latter as determined by average fibre diameter and medullation percentage. The fleece weight and fleece quality characters are moderately to highly heritable and are negatively related genetically. Consequently, selection within the indigenous breeds based on an index combining first six monthly greasy fleece weight and average fibre diameter improves both the characters. Because the level of performance of indigenous breeds is low, the progress through selection is necessarily slow. Selective breeding against medullation percentage was undertaken on Deccani sheep at Sheep Breeding Research Station, Poona and on Bikaneri and Lohi at Government Livestock Farm, Hissar in 1950s.¹ There was some decrease in medullation percentage and a correlated decrease in average fibre diameter. For quicker improvement, it may, however, be desirable to grade up the inferior wool producing breeds with indigenous superior wool breeds or crossbreeding them with exotic fine wool breeds.

30.1.25 Grading up with superior indigenous breeds especially Bikaneri was undertaken in Andhra Pradesh, Karnataka, Tamil Nadu and Uttar Pradesh. The grading up programme did not do well in the southern states as the Bikaneri rams did not survive long, presumably because of their poor adaptation to hot and humid climate. There was, however, an improvement in wool production and quality as reflected in an increase in staple length and a decrease in medullation percentage and average fibre diameter. The improvement through such grading up has been quite successful in Uttar Pradesh as neither the rams of Rajasthani breeds nor their crosses faced serious problem of survival as in the southern states. The selection within indigenous breeds against medullation percentage and grading up with superior indigenous breeds did not result in reduction in medullation percentage and average fibre diameter to the standards required for fine apparel production.²

30.1.26 Sporadic attempts at crossbreeding indigenous breeds with exotic fine wool breeds like Merino, Rambouillet, Polworth etc. have been made. The number of exotic sires in almost all the cases had been small. The results, in general, indicated the superiority of crossbreds over the indigenous purebreds involved in crosses in body weight, greasy fleece weight, and fleece quality except in Polworth crosses with Rampur Bushair in Uttar Pradesh. Except for the survivability

1 Acharya R.M. (1974). Evaluation of Native Breeds of Sheep for Wool and Mutton and Scope for Introduction of Exotic Inheritance. *Indian Journal of Genetics*, 34 945.

2 Recent Efforts at Sheep Improvement : Research in Animal Husbandry, Review of work done during 1924-54, ICAR, New Delhi.

and lambing percentage, there was no heterosis exhibited by the crosses as shown by their superiority over their parent breeds. The survivability of halfbreeds was similar to that of the indigenous breeds involved in the crosses but higher crosses did show higher mortality compared to the indigenous breeds. There was some improvement in wool quality with the increase in exotic inheritance over 50 per cent. Where more than one exotic breeds were used on the same indigenous breed, Rambouillet performed better in crosses. Similarly where more than one indigenous breeds were used with the same exotic breed, the carpet wool breeds, particularly Bikaneri (Magra), showed superiority.

30.1.27 The *Ad hoc* Committee¹ on sheep breeding policy had recommended that in the northern temperate zone, crossbreeding with Rambouillet and/or Merino should be undertaken for improvement of fine wool. The Committee suggested that the level of exotic inheritance should be maintained at 50 per cent except in case of sheep breeding farms and selected areas. The present experience in this region, however, indicates that crossbred animals with 75 per cent exotic inheritance do perform better and pose no serious disease or management problems.²

30.1.28 A research project designed to evolve new wool breeds suitable for arid and semi-arid regions was started at CSWRI in 1964. It involved the crossing of Rambouillet with three diverse indigenous types (medium-fine carpet/medium apparel type—Chokla; medium carpet wool—Jaisalmeri, and coarse hairy carpet wool—Malpura). Sheep with three levels of Rambouillet inheritance, viz., 50, 62.5 and 75 per cent were interbred. The results indicated that there was little improvement in body weight and greasy wool production beyond 50 per cent exotic fine wool inheritance. There is no serious decline in performance of the progeny produced from interbreeding of crossbreeds. The halfbreeds posed no serious management and disease problems. Higher crosses, however, showed lower adaptation to high temperature and were more susceptible to diseases.

30.1.29 Rambouillet-Chokla halfbreeds produce in a year about 2.5 kg of greasy wool of 58 to 64 count which is suitable for manufacturing medium quality apparel. Rambouillet-Malpura halfbreeds produce about 2 kg of greasy wool per year which can be used for superior quality carpet or woollen apparel. Economic gains from improvement in wool alone were around 25 per cent in Rambouillet × Chokla halfbreeds over Chokla. Rambouillet-Jaisalmeri halfbreeds though superior to Jaisalmeri in wool production and wool quality, pose serious

¹ Report of the *Ad hoc* Committee on the Sheep Breeding Policy. Ministry of Food & Agriculture, Community Development & Cooperation (Department of Agriculture), 1970.

² Annual Report 1974, CSWRI (ICAR), Avikanagar, Rajasthan.

problem due to black patches on the fleece which reduce considerably the return from the sale of wool. At 75 per cent of exotic inheritance the indigenous types involved in crossing did not show any significant difference in their performance. Considering the crossbreeding results now available, we are of the view that the level of exotic fine wool inheritance should be stabilised around 50 per cent in arid and semi-arid areas and the crossing of exotic fine wool breeds with black faced indigenous breeds should be avoided.

30.1.30 During the Fourth Plan, the ICAR sponsored an All-India Coordinated Research Project (AICRP) on Sheep for Fine Wool with coordinating units at CSWRI and with centres at CSWRI Tal Farm in Himachal Pradesh and Ootacamund in Tamil Nadu. The project commenced functioning in 1971. This project has now been combined with AICRP on sheep for mutton and a single All-India Coordinated Research Project on sheep breeding has been formulated. Some more centres for fine wool are contemplated in different regions of the country. The objective of the combined project is to develop superior fine wool breeds suited to different agroclimatic regions of the country. The exotic breeds being used for crossbreeding for fine wool production are Russian Merino and Rambouillet. The main emphasis in the project is to study breed combinations, level of exotic inheritance, heterosis in production traits and problems involved in interbreeding of crossbreds for new breeds. Ancillary studies on nutrition, physiological response to environment, reproduction and disease susceptibility are also envisaged. We are informed that some encouraging results have been obtained. The crossbreds have shown considerable improvement in fleece quality though only a marginal increase in greasy wool production. Since the project started during the later part of the Fourth Plan, it is too early to assess the progress. However, the development of infrastructure for the implementation of the project has been slow. We suggest that since this project is of great importance necessary steps should be taken to remove bottlenecks in its expeditious execution.

30.1.31 The total population of sheep in Jammu and Kashmir, Himachal Pradesh and hilly areas of Uttar Pradesh, Chokla and Nali sheep in Rajasthan, Nali sheep in Haryana, and Pattanwadi sheep in Gujarat is around 5.38 million. These sheep may be brought under crossbreeding for fine wool production using Rambouillet and/or Merinos. In addition, a small number of about 4,000 Nilgiri Sheep of Nilgiri hills in Tamil Nadu and better woolly sheep in Arunachal Pradesh may also be involved in breeding programmes for fine wool through crossing with Rambouillet/Merino. Because of large acreage of excellent grazing land available in the Nilgiris and Kodai hills of Tamil Nadu,

there is great scope for increasing fine wool sheep production in these areas.

30.1.32 Considering that about 60 per cent of the total population consists of breedable ewes the total number of breedable ewes available for fine wool production programme would be about 3.23 million.

Assuming one ram for 30 ewes, the total number of exotic rams that will be required to cover all the breedable ewes available at present in the fine wool producing areas through natural service would be 0.1 million. But assuming one ram to be sufficient for artificial insemination of 600 ewes the number of rams required will be only 5,000. To make 0.1 million exotic rams available, it will be necessary to import 20,000 rams and 80,000 ewes over a period of four years. Taking 60 per cent lambing rate, 30 per cent mortality upto breeding age, 10 per cent adult mortality and 25 per cent wastage due to lack of libido, poor semen quality and temporary or permanent infertility, it will require 10 years to provide the number envisaged. In a situation like this artificial insemination (AI) would be of help.

30.1.33 In Jammu & Kashmir, Himachal Pradesh and hilly region of Uttar Pradesh, crossbreeding is being done at present through natural service either by providing exotic rams to the breeders at subsidised rates or providing them during the breeding season without any charges. In our opinion, the latter is more feasible as breeding can be restricted to the optimum breeding seasons and the rams during nonbreeding season can be efficiently maintained at ram depots maintained by the Animal Husbandry/Sheep Husbandry Department.

30.1.34 In the States of Rajasthan, Haryana and Gujarat it will be necessary to provide either AI facilities for crossbreeding or start introduction of exotic inheritance gradually through the distribution of rams first with 50 per cent and later 75 per cent exotic inheritance. This is considered necessary because of the problem of lowered fertility in the exotic rams during summer months in the region when maintained under the prevailing husbandry practices. Till such time the AI facilities are made available, halfbred rams may be provided. With the extension of AI to these areas, the quarterbred population may be covered through AI using exotic rams, thus producing animals with 62.5 per cent exotic inheritance or alternatively they may be covered naturally with rams of 75 per cent exotic inheritance producing half-breds.

30.1.35 Improvement of carpet wool production : Improvement in carpet wool production and quality can be brought through selection based on six-monthly fleece weight and medullation percentage incor-

porated into an index, since the two characters are genetically related negatively. Some attention may also be paid to lustre in the selection of rams. The emphasis in selection should be to eliminate kempy and completely hairy fibres to reduce percentage of heterotypes to around 20 per cent.

30.1.36 Selective breeding should be undertaken among sheep of important carpet wool breeds numbering about 4.50 million in Rajasthan such as Marwari, Jaisalmeri, Pugal and Magra and among 1.25 million Marwari and other woolly sheep except Pattanwadi in Gujarat. We recommend that a few large sheep breeding farms of each of these four breeds may be established in their respective home tracts. Rams produced at these farms should be distributed to the progressive sheep farmers who may also be encouraged and helped to rear selected breeding rams which could be distributed to other sheep farmers. Thus, the improvement brought about through selection for fleece quality and weight at the Government farms could be transmitted to the flocks of progressive breeders and through rams of these flocks to the total population. Since Indian carpet wools lack lustre, improvement through selection or through crossing with carpet wool breeds from some middle eastern countries (e.g., Iran and Iraq) which produce lustrous wool may be undertaken by the ICAR on experimental basis. In addition to the improvement coming through selective breeding there will be an increase in carpet wool production and some improvement in quality through crossbreeding the inferior woolly type sheep being improved for mutton production. The crossing of Malpura, a very hairy and inferior carpet wool breed, with Rambouillet at CSWRI main station, and of Coimbatore, a hairy breed, with Corriedale at its southern substation has resulted in substantial improvement in wool production and quality bringing it to superior carpet quality. Similar improvement in wool production and quality has also been obtained at large sheep breeding farms at Manidapalli, Hyderabad in crosses of Deccani and Nellore, two southern hairy breeds, with corriedale.

Breeding for Mutton Production

30.1.37 Since the characters connected with mutton production are moderately to highly heritable and the generation interval in sheep is short, selection within the indigenous breeds will bring considerable improvement in mutton production. Some of the Indian breeds like Mandya have dressing percentage comparable with those of exotic mutton breeds. However, the selection within the indigenous breeds would be slow in bringing improvement in mutton production because of extremely low level of present production.

30.1.38 Improvement in inferior indigenous sheep through grading up with superior indigenous mutton breeds and through crossing indigenous ones with exotic mutton breeds seem to be the alternatives for making faster improvement. Experiments on improvement of indigenous sheep for mutton production through crossing carpet wool breeds such as Nali and Lohi with mutton breeds like Mandya and Nellore, carried out at Haryana Agricultural University, Hissar did not show any marked improvement in body weight, efficiency of feed conversion and carcass yield.¹ Similarly, exploratory trials on crossbreeding of Mandya with Southdown, Dorset Down and Dorset Horn undertaken at livestock Research Station, Hessarghatta, Bangalore did not prove successful. However, the results of breeding experiments undertaken on a small scale involving Somali ram at the Sheep Breeding Farm, Poona were encouraging.² These experiments have been carried out on a very small scale and may not fully reflect the effectiveness of the improvement systems available. During the Fourth Plan, the ICAR sponsored an All-India Coordinated Research Project on Sheep for mutton with coordinating agency at CSWRI and centres at CSWRI, IVRI, Izatnagar and Andhra Pradesh Agricultural University Livestock Research Station, Palamner (Chittoor district). The project aims at developing new mutton breeds producing lambs weighing 30 kg. at 6 months of age and suitable for different agroclimatic regions of the country through crossing indigenous breeds with exotic mutton breeds (Suffolk and Dorset). Though the project started in 1971, crossbreeding trials could be taken up only in 1973 because of delay in import of exotic stock. The work under this project should be pursued vigorously so that results may become available at an early date. Little work has been done in the country on evaluation of carcass quality, laboratory evaluation of meat quality, and meat processing. We strongly recommend that in view of great potentiality for export of mutton, this work should be initiated on priority basis at the CSWRI, IVRI and in agricultural universities.

30.1.39 Excluding the animals included in the fine wool breeding programme and 5.75 million sheep included in the carpet wool programme comprising primarily Marwari, Jaisalmeri, Chokla and Magra breeds in Rajasthan and Marwari sheep in Gujarat, the population of woolly type animals in Haryana, Punjab, Western Uttar Pradesh, Rajasthan, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu

1 Balaine D.S., Singh J., Acharya, R.M. and Kanujia, A.S. 1970. Post Weaning Feed Lot Performance of Nali and Lohi Sheep and their crosses with Nellore and Mandya. *Indian Veterinary Journal*, 48 : 50.

2 Recent efforts at sheep improvement, *Research in Animal Husbandry—Review of work done during 1924-25*. Indian Council of Agricultural Research, New Delhi.

and Bihar number around 19 million. The hairy type animals in Andhra Pradesh, Karnataka and Tamil Nadu is around 10 million. We recommend that the woolly breeds be crossed with the exotic dual purpose breed like Corriedale to evolve a dual purpose breed which would improve the quantity and quality of wool produced. The cross-breeds so obtained would produce better carpet quality wool, would have better live weight and higher dressing percentage. In addition to the crossbreeding of these breeds with Corriedale, some of the important heavier carpet wool breeds, viz.; Magra, Nali and Pattanwadi may be used on the woolly breeds like Bellary and Deccani in Andhra Pradesh and Karnataka.

30.1.40 The hairy breeds other than Mandya and Nellore should be graded up with Nellore and Mandya, the two important South Indian mutton breeds. In Mandya and Nellore selective breeding based on six monthly body weight should be practised. As soon as the experience is gained of crossing the South Indian mutton breeds with some of the exotic mutton breeds being undertaken under the All-India Coordinated Research Project on Sheep Breeding for Mutton, hairy breeds including the Mandya and Nellore and the crosses of South Indian woolly breeds with Corriedale should be considered for crossing with exotic mutton breeds.

30.1.41 Out of the total population of woolly type sheep of 19.26 million about 11.6 million are breedable ewes. For covering all these ewes through AI, 20,000 exotic rams would be needed and for producing that number a population of 4,000 exotic rams and 20,000 ewes would be required. It would thus be advisable to establish 4 large exotic sheep breeding farms in different regions of the country for undertaking crossbreeding with Corriedale. Each farm should have 5,000 exotic breedable ewes and followers. It would also be necessary to establish large farms for maintaining exotic stud rams during the nonbreeding seasons. These farms should be located in the breeding tracts where AI is to be provided. The rams should be issued to the intensive sheep development blocks only during the breeding season.

30.1.42 If alternative breeding system is adopted for introducing gradually the exotic inheritance, (i.e., first covering the total population through natural service using halfbred rams and later, as AI facilities) are extended to these areas covering quarterbred animals through AI with exotic rams or through natural service with 3/4 bred rams, 0.39 million halfbred rams would be required. These rams can be produced over a period of 10 years by covering about 1,60,000 indigenous breedable ewes with exotic rams. This would call for establishment of large sheep breeding farms in different States for undertaking crossbreeding of indigenous breeds with Corriedale. The

halfbred rams so produced should be distributed among the sheep farmers of the region and the halfbred female progeny should be backcrossed to the exotic breed to produce $3/4$ bred rams for distribution in the second cycle of the breeding programme to produce halfbred progeny in the field. Halfbred rams would also become available in areas where crossbreeding with exotic rams through AI is being carried out. Such rams can be purchased at remunerative prices and reared at ram rearing centres or given directly to sheep breeders after weaning or later. This would cut down the expenditure on producing these rams on government farms.

Artificial Insemination in Sheep

30.1.43 Artificial Insemination (AI) in sheep has played a significant role in improving sheep within a short period of time in Russia and in some western and eastern European countries. One of the reasons for the success of AI in these countries is the large size of their sheep flocks, which are maintained more or less on a stationary basis on farms. In India, this technique, though taken up on an experimental basis for some years, has not yet been extended to the field on a large scale except in Rajasthan. Artificial insemination in sheep cannot be adopted as easily as in the case of cattle and buffaloes in view of certain problems connected with dilution and preservation of ram semen. The dilution factor of the ram semen is low and its preservability is very poor. Diluted ram semen, not used within 6 to 8 hours, loses its fertility very rapidly and as such its field use is beset with several technical difficulties. Enquiries made from State Departments of Animal Husbandry show that even in States like Himachal Pradesh, Jammu & Kashmir and Gujarat where woolly type of sheep are found in large numbers and crossbreeding in sheep has been undertaken, this technique has not been put into practice in the field. In Himachal Pradesh and Jammu & Kashmir, the breeding season in the ewes coincides with the migration periods of flocks, viz., spring and autumn and the migration routes are such that they are not easily accessible. This makes it difficult to transport semen from the collection centres within a short period of time or to have any mobile AI unit to follow the flocks. We have been informed that in Gujarat, AI was attempted in private flocks as a demonstration at one AI Centre using semen from exotic rams but the results obtained were rather poor. However, in Rajasthan this technique has been adopted on a comparatively large scale with encouraging results.

30.1.44 Apart from the difficulties of introducing AI successfully

in the migratory flocks in hot arid plains, there are problems with regard to the quality of semen from exotic rams in the hot summer months when maintained under the prevailing husbandry practices. We have been informed that under such conditions rams of exotic breeds exhibit temporary or permanent cessation of libido and produce poor quality semen as a result of exposure to high temperature and radiation. However, studies carried out at the CSWRI and at some sheep farms and AI Centres in Rajasthan have shown that the maintenance of exotic rams under shade during the day with good air movement and availability of drinking water and grazing them and offering them supplementary feed and fodder during cooler hours of the day, preferably at night, circumvent to a large extent the problem of lowered libido and poor semen quality during summer.¹ Another practical difficulty that is being faced by the sheep flock owners in Rajasthan is that the inseminators are not able to reach the village flocks early in the morning before the flocks are taken out for grazing outside the village. Thus, even in nonmigratory flocks in the plains there are a number of difficulties which prevent adoption of AI in sheep on a large scale.

30.1.45 In spite of the various constraints mentioned above we are of the view that serious attempts should be made to try out this technique in the breeding of sheep in different parts of the country in view of the large scale crossbreeding programmes that have been recommended for rapid increase in wool and mutton production. Because of the paucity of rams of exotic breeds and difficulties in their use through natural service when maintained with the village flocks in the plains, AI in sheep is to be considered as a method more of necessity than of choice. We recommend that intensive researches should be carried out at the CSWRI, IVRI and agricultural universities for improving the methods of semen dilution and preservation, so that diluted semen could retain fertility for a longer period. As non-adoption of AI in sheep on a large scale is mainly due to the difficulty in semen preservation beyond 6-8 hours of collection, a quicker transport and more frequent supply of semen would have to be arranged, or AI Centres would have to be set up in close vicinity of the breeding areas. The Director, Sheep and Wool, Rajasthan has informed us that in his State some flockowners or graziers have been trained in detection of oestrus in ewes and practising AI in flocks. This practice should be tried on an experimental basis in other important sheep rearing States. We recommend that a few stationary as well as migratory flocks should be selected in the

¹ Annual Report, 1974. Central Sheep and Wool Research Institute, Avikanagar, Rajasthan.

plains for this trial. Good quality semen and sterilised inseminating equipment should be supplied to the owners of such flocks daily during the breeding season from a nearby AI Centre. In the case of migratory flocks in the hilly areas as the migratory routes and the time of migration more or less fall in a definite pattern, mobile AI units should be organised with facilities for transporting breeding rams and insemination equipment. We recommend that the important sheep rearing States should organise AI in sheep on a pilot basis in selected centres and if it proves to be a success it should be gradually extended to cover more areas and larger sheep population.

Programmes for Meeting Nutritional Requirements

30.1.46 Inadequate availability of feeds and forages due to reduction in area and deterioration of grazing lands poses a serious threat to sheep production because of high livestock density. This has been the compelling reason for large scale migration of sheep in search of grazing and water resources away from their abodes and has become a pattern of sheep rearing in many States (paragraph 30.1.6). Thus, the most important and difficult problem facing the sheep industry is to meet the nutritional requirements of the current sheep population. To face this problem, it is necessary to develop arid and semi-arid wastelands into pastures and provide sufficient top feed through plantation of suitable fodder trees, utilise various agricultural and industrial byproducts, conserve fodders and to increase production of coarse grains for meeting the requirement of highly productive sheep.

30.1.47 Experiments conducted at Balwant Rajput College, Agra have shown that a low protein and high energy ration produced more wool than a high protein and low energy ration. Energy is, therefore, the prime factor in sheep nutrition. A level of 10 per cent protein in the ration has been found to be adequate for wool production since feeding of protein beyond this level does not have any beneficial effect on wool yield.¹ An animal weighing 30 kg needs about 400 g of total digestible nutrients (TDN) and 40 g of digestible crude protein (DCP) per day for optimum wool production within its genetic potential. This level of intake of energy and protein can be ensured if the foraging material available in the pasture is of very high quality and sheep are allowed to graze for longer hours. This much of nutrient intake under the present conditions of sheep husbandry is not readily met with, resulting in low wool yield. For meeting the nutritional requirement of sheep to express their genetic potential for wool/meat

¹ Final Report of the ICAR Scheme on Investigation on the quality for Wool and Meat in relation to Nutrition of Sheep. Mimeograph. Balwant Rajput College, Agra, 1966.

production we are of the view that the greater part of arid region (31.70 million hectares) which is suitable only for livestock raising should be utilised more profitably for range land and pasture development. In our Interim Report on Desert Development we have discussed in para 9.28 the work done on range management by the Central Arid Zone Research Institute¹ (CAZRI), Jodhpur with special reference to water scarcity conditions. It has been shown that grass production could be substantially stepped up through land development, fencing, reseeding, use of fertilisers, soil conservation and water management. The results indicate that with adequate protection and controlled grazing, the forage yield on the range lands could be practically doubled in about 3-5 years time. Reseeding, fertiliser application, bunding, provision of shelter belts, fodder tree plantation in the pastures and such other measures should be undertaken to provide adequate grazing and top feed from the range land. The development of village grazing lands should be entrusted to the village panchayats or Sheep Breeders' Cooperatives which should be provided with proper assistance for developing and managing the village pastures. This suggestion should receive special attention in the sheep grazing areas of Rajasthan, Gujarat, Karnataka and the valleys and the alpine pastures in Jammu and Kashmir, Himachal Pradesh and Uttar Pradesh.

30.1.48 In addition to the development of pastures and range lands in arid areas, improvement of natural pastures in States like Himachal Pradesh, Jammu & Kashmir and hilly areas/regions of Uttar Pradesh and southern states should be undertaken through re-seeding and application of fertilisers. Further, large blocks of government range lands located far away from villages should be developed mainly as grass reserves for hay making. It would be necessary to include fodder crops, especially leguminous fodders, in the cropping pattern in irrigated areas. Possibilities of utilising rice fallows in Jammu & Kashmir and other hill states for growing early maturing legumes should be explored. Introduction of perennial legumes like siratro (*Phaseolus atropurpureus*) and Rawan (*Dolichos lablab*) in the pastures will help to meet the protein requirement.

30.1.49 Certain minerals like sulphur, copper, cobalt and zinc are of special significance in sheep nutrition for wool production. Not much work has been done on this subject in India. However, the study² undertaken at the U.P. College of Veterinary Science and

1 Ahuja, J.D. 1973. Forage Production with special reference to arid zone. Central Arid Zone Research Institute, Jodhpur.

2 Katiyar, R.C. and Talpatra S.K. 1968. Trace Elements and their effects on pasture consumption and plane of nutrition of grazing sheep. Indian Journal of Veterinary Science and Animal Husbandry 38 ; 342.

Animal Husbandry, Mathura indicated that provision of additional cobalt along with concentrates increased wool production. We are of the view that there is an urgent need to carry out survey on the micro nutrient (sulphur, cobalt, copper and zinc) status of soils and plants including fodder and their availability to sheep in areas of intensive sheep rearing and investigate the effects of their absence.

30.1.50 The success of commercial meat production depends on achieving maximum growth within the shortest possible time. Under the present conditions of sheep husbandry, the low body weight at different stages of development is due to the effect of poor genetic constitution as well as inadequate nutrition of lambs during pre and post-weaning periods. Studies¹ conducted at the U.P. College of Veterinary Science and Animal Husbandry, Mathura revealed that the slaughtering of lambs (Magra) at the age of six months was most economic. However, the general practice followed is to slaughter the lambs at the age of 9 to 12 months. We, therefore, suggest that efforts should be made to maximise growth to the optimum genetic potential and obtain desirable carcasses at an early age.

30.1.51 Under the present husbandry practices the body weight of different meat type breeds at six months of age is only 15 to 18 kg. By crossbreeding the indigenous breeds with exotic fine wool and mutton breeds and by providing adequate nutrient inputs, 18 to 20 kg weight can be obtained at weaning age and 30 to 35 kg at the age of six months. The results obtained at CSWRI have already demonstrated this potential.² If the lambs are maintained on pasture or all-forage rations alone it is not possible to attain these weights. Additional amounts of energy and protein have to be provided through supplementation of concentrates or highly nutritious leguminous hay so as to provide energy and protein twice the requirement for maintenance. Some conserved leguminous fodder and coarse cereals should, therefore, be ensured for supplementary feeding of sheep especially for mutton production. In addition, supplementary feeding of sheep with agricultural and industrial byproducts for meeting energy and protein requirements should be encouraged. We recommend that the feed compounding industry should manufacture cheap supplementary rations for sheep, utilising agricultural and industrial wastes and non-protein nitrogenous substances.

Health Cover Programmes

30.1.52 The success of intensive sheep production programmes will

1 Srivastava V.K. and Roy A. 1969. The influence of season and age on the carcass quality of Magra lambs, IJVS 39 : 294.

2 Half-yearly Technical Progress Report, January to June, 1973, CSWRI Avikanagar.

to a large extent depend on the provision of an effective health coverage. The flocking habit of sheep is highly conducive to quick spread of communicable diseases. During migration, sheep from different areas mix up in the grazing zones and follow common migratory routes. Thus, one diseased flock may contaminate large areas of the grazing lands on its route causing serious threat to the other flocks grazing over those areas. As such, it is highly necessary to undertake routine prophylactic measures against the commonly occurring diseases as recommended by us in paragraph 5.17 of the Interim Report on Poultry, Sheep and Pig Production. We have stressed in the Interim Report that sheep should be regularly protected against diseases like sheep pox and enterotoxaemia. We have also emphasised the imperative need for periodic drenching of sheep with suitable anthelmintics as gastrointestinal parasites and liver flukes are responsible for causing serious losses among sheep. Broad spectrum anthelmintics as well as specific ones are now being marketed in the country and their judicious administration would considerably reduce the losses due to worm infestations. Sheep are also highly prone to infestation by external parasites probably on account of the covering afforded by the fleece. These ectoparasites cause considerable damage to the health of the sheep and to the quality of their fleece and skins. Very effective sheep dips are now available and with their regular application, menace of ectoparasites can be effectively controlled. As such, the extension veterinarians should visit the sheep flocks frequently for undertaking vaccination, periodic drenching of sheep with anthelmintics and for arranging sheep dips as recommended by us in the Interim Report on Poultry, Sheep and Pig Production. Lung worm infestation is responsible for causing serious losses in the sheep especially in North temperate regions. Recently, an irradiated vaccine against lung worm infestation has been developed by the IVRI which has been reported to give satisfactory results under experimental conditions. It is necessary that this vaccine should be prepared on a large scale by the Institute for field use at an early date.

30.1.53 Some other sheep diseases which have recently assumed considerable importance are blue tongue and infectious epididymitis. Blue tongue appeared in a flock of exotic sheep in Maharashtra in August, 1973 and killed about 10 per cent of exotic sheep and a large number of lambs within a couple of months. Material from this outbreak was sent to the Veterinary Research Institute, Onderstepoort, South Africa, which confirmed the disease. We are informed that some quantity of monovalent vaccine against type 16 was recently imported for vaccination at this farm and the matter regarding the advisability of importing polyvalent vaccine to protect animals at the infected farm

in Maharashtra is under the consideration of the Government of India. Since the disease at present appears to be confined to a small area, it is highly important that stringent steps are taken to eradicate the infection. We recommend that the Animal Husbandry Division of the Union Ministry of Agriculture and Irrigation should lay down a policy for its eradication. The IVRI should initiate research work on this disease and should keep itself in readiness to start the manufacture of blue tongue virus vaccine, whenever required.

30.1.54 We have been informed that infectious epididymitis has become a serious problem at some of the exotic sheep farms. Since epididymitis leads to impaired fertility and other breeding problems, the IVRI and agricultural universities should undertake a systematic survey to determine its incidence at the different sheep farms in the country. The epizootiology, pathology and pathogenesis of the disease should be studied and suitable preventive measures should be devised for the guidance of breeding farms.

30.1.55 Pneumonic conditions have been reported to be causing heavy mortality in lambs at the exotic sheep farms. The problem of respiratory diseases in sheep requires special attention. The IVRI and agricultural universities should carry out detailed studies on the pathology and pathogenesis of pneumonias in sheep with a view to devising suitable preventive measures.

Wool Shearing, Grading and Marketing

30.1.56 Shearing : In the different regions of the country wool shearing practices vary and sheep are shorn thrice, twice or once a year, using indigenous crude hand shears. Moreover, shearing is disorderly, leading to a mixing of fleece from different parts of the body. Shearing in this way results in double cuts reducing staple length of the fleece and causing skin injuries to the animals. Improved hand shears are now available which avoid double cuts in fleece and injury to the animals. More recently, machine shearing has been introduced in some states. Since machine shearing is more efficient in consideration of time and quality of the end product, besides avoiding injuries to the animals, we recommend that machine shearing should be practised in all the major wool producing States. Further, care should be taken to see that during shearing the belly and leg wool are shorn first and kept separate. The rest of the fleece should be shorn and handled separately. These measures would help the sheep farmers in obtaining better returns. As regards the frequency of shearing, the experiments at CSWRI have shown that twice a year shearing is more pro-

fitable than once or thrice a year. Once a year shearing causes problems of wool shedding and skin diseases, while thrice a year shearing reduces staple length without significantly improving greasy wool production. This observation of CSWRI should be widely publicised for the guidance of sheep owners.

30.1.57 Skirting and primary classing of wool on the shearing floor immediately after shearing are not practised in India contrary to what is done in most of the wool producing countries. This results in mixing up of all types of wool. This is distinctly a disadvantage to the producers. It would, therefore, be desirable that skirting and primary classing be introduced by educating the flock owners. Skirting would involve separation of wool from belly and legs and any coloured, heavy burry and soiled wool. The fleece of adult sheep and lamb may also be separated. The washing of sheep prior to shearing and skirting has resulted in 5.7 to 33.2 per cent premium in sale price in Rajasthan.¹ Later fleece can be classed based on feel (handle) which is the simplest way of determining fineness, hairiness and vegetable faults. Fleeces with very short staple length should also be separated. This work could be entrusted to the shearing party. In Rajasthan the Sheep and Wool Department undertakes machine shearing and should be able to take up skirting and primary classing too. This would to a large extent help in keeping separate the fleeces into appropriate quality classes and may not require any further grading. We recommend that sheep farmers be educated by the Sheep and Wool Extension Agencies of State Animal Husbandry/Sheep Husbandry Departments on shearing practices and on skirting and primary classing. This would benefit the wool producers and also the wool industry.

30.1.58 Grading : Wilful adulteration with burrs, dust, goat hair, pulled and limed wool etc., in the consignment of clipped wool is not an unusual malpractice. The Government of India introduced compulsory grading and marketing under "AGMARK" in accordance with the provision of Agricultural Produce (Grading and Marketing) Act, 1937 with effect from February, 1955. Under the scheme a special inspectorate staff is located at Bombay with centres at Beawar, Bikaner, Bombay, Delhi, Fazilka, Jamnagar, Madras and Rajkot. The grading of wool is based on three factors, viz., colour, clean yield and type ensuring that the consignments are free from admixtures with other animal and vegetable fibres and extraneous matter. This system does not take into consideration other factors such as length, fineness etc.

30.1.59 Under an FAO/UNDP project in Rajasthan a new system of grading was introduced in 1964 which is based on length, fineness,

¹ Marketing of wool in India (1964). Directorate of Marketing and Inspection, Ministry of Food & Agriculture (Department of Agriculture), Government of India.

colour and vegetable contents. The wool is classified into superfine (Super-A), fine (A), medium (B), strong (C) and coarse (D). Since the Indian wool is medullated and noncrimpy and feel being considered an important technique in determining fineness sometimes leads to higher grading of wools with softer feel. On the basis of length the wools are classified as long (6 cm and above) and short (below 6 cm). Similarly, wools are classified on the basis of colour as white, light yellow and heavy yellow. On the basis of vegetable matter the fleeces are further classified into light burr (LB), medium burr (MB) and heavy burr (HB). Wool is thus classified into 90 different grades. This system has now been extended with some modifications to the States of Jammu & Kashmir, Himachal Pradesh, Punjab, Haryana, Gujarat, Uttar Pradesh and Karnataka. We are of the view that the present grading system is very cumbersome and should be revised to have lesser number of grades. It would be desirable to set up a Central Wool Testing Laboratory to provide wool testing services free or on nominal charges in all the wool producing States. Further, the wool grading system should be standardised and graded wool should be evaluated for effectiveness of grading by means of physical characteristics and also for their manufacturing quality. Such studies should be carried out at CSWRI in collaboration with the State Animal Husbandry/Sheep Husbandry Department.

30.1.60 Wool grading has been in vogue in Rajasthan since 1964, but only a small percentage of total wool produced is graded and marketed through the wool grading centres. The position is even less satisfactory in the States where wool grading has been introduced recently. Since only a small quantity of wool is available for grading, the lots in different grades are small and do not meet the requirements of large mills. The State Animal Husbandry and Sheep Husbandry Departments are paying market rates to the sheep breeders. Consequently the price of graded wool is much higher than the wool available in the *mandis* due to an increase in the overhead cost on transport and grading. It will, therefore, be advisable that the concerned State Government should enact suitable legislation to ensure that all the wool produced in the State is passed through the grading centres and that the grading and marketing should not be the responsibility of the State Animal Husbandry or Sheep Husbandry Department. These departments should primarily concentrate on sheep development activities.

30.1.61 Marketing: There are no organised markets for wool. The village *beoparies* or agents of big wool merchants or of woollen mills buy wool from the shepherds mostly on per sheep or per fleece basis, against money advanced to the shepherds. The wool after

being shorn is generally brought to the *mandis* where it is sold through commission agents. Only a small fraction of the total wool produced is being purchased by the Animal Husbandry and Sheep Husbandry Department in States where wool grading has been introduced. Wool purchased by these departments is graded and sold through open auction. The practice for the sale of wool varies from one *mandi* to the other. At some places, wool is sold through open auction, whereas in others bargains are finalised through brokers by private negotiations.

30.1.62 The present marketing system for wool allows very large profits to the brokers and other intermediate agents and does not provide remunerative price to the sheep farmers. It is necessary to have organised wool markets by making provision of Agricultural Produce (Grading and Marking) Act, 1937, applicable to wool in the important wool producing States so that all the wool is sold through regulated markets. A price incentive may be given to induce the producers to bring clean and better quality wool for sale in the market. Necessary facilities for wool grading and warehousing should be provided in the regulated markets. Easy credit facilities to the sheep farmers should be made available so that they can avoid selling of wool to the *beoparies* at distressed prices.

30.1.63 The Agricultural Produce (Grading and Marking) Act, 1937 has recently been extended to wool in the State of Rajasthan and some wool is being sold at *Krishi Upaj Mandis* through open auction. The Act under which warehouses are being set up both by the State and the Centre does not include wool in the schedule of commodities accepted by the warehouse. In our opinion the Act should also cover wool and the wool markets should be preferably established near the major areas of production so that the sheep farmer can sell his produce directly in the market. It may also be desirable to organise sheep farmers' cooperatives for organising sale of wool and live animals. Such cooperatives can extend credit facilities to the members and thus save them from the clutches of *beoparies* and money lenders. The details in regard to their set up, functions and working have been discussed in paragraphs 5.21—5.24 of the Interim Report on 'Poultry, Sheep and Pig Production'.

30.1.64 Wool Board : The experience with the State Animal Husbandry/Sheep and Wool Departments undertaking wool marketing has not been very encouraging. Major part of the sheep and wool development activity has been hampered because of the involvement of the development staff in wool purchases. Further, the limitations imposed by Government purchase and disposal procedures create problems in the efficient running of such a marketing system. The

overhead costs in purchase, transport, grading and disposal of wool are prohibitive. It is on this account that the Department of Sheep and Wool, Rajasthan in spite of its best efforts over a number of years has not been able to handle even 10 per cent of the total wool shorn in the State. Either the sheep breeders should organise themselves into producers' marketing cooperatives, handle the wool in an appropriate manner and bargain for better prices in an organised wool sale or the States should set up an independent body to look after these activities.

30.1.65 There may be difficulties in holding large quantities of wool for any length of time because of absence of warehousing facilities. Considering these problems it may be desirable to have a Board in each important wool producing State. All the wool produced in the State must be disposed of through the Board. The Board should ensure remunerative prices to the producers and arrange for the purchase of wool from even the remote areas. It should have facilities for wool packaging, pressure balling, proper identification and transport. The Board would further have its own facilities for wool grading and warehousing. The Board may also encourage the setting up of small scale wool based handicraft industry in the villages to provide more remunerative and all the year round employment to sheep farming families.

30.1.66 The Wool Board may undertake machine shearing of sheep, providing such facilities on the migration routes as well. The wool may be purchased from nomadic sheep breeders and they may be provided with bank pass books so that they can draw required amounts out of their credit at a branch of the nationalised bank. Such a practice would free them from the clutches of *beoparies* and risks of carrying large cash during migration. We, therefore, recommend that wool marketing in important wool producing States be properly organised through sheep farmers' cooperatives by extending the Agricultural Produce Marketing Act to wool and providing proper warehousing and wool grading facilities in *Krishi Upaj Mandis*, or through constitution of statutory wool boards which should take the responsibility of sheep shearing, wool grading, warehousing and marketing wool. We are happy to learn that the Union Ministry of Agriculture and Irrigation has recently initiated steps to organise wool marketing boards in important wool producing States.

Marketing

30.1.67 There are no organised marketing yards for sheep. Animals are generally purchased by the middlemen and transported on foot or

by trucks to the nearest slaughter house where they are sold in lots. Since large slaughter houses and meat markets are located in metropolitan cities, animals have to be transported over long distances and to far off places. This involves considerable economic losses due to mortality and shrinkage in live weight. There is thus great need for providing market yards for the sale of live animals in major sheep rearing areas. The market yards should have facilities for feeding, watering and holding animals for a few days. We recommend the setting up of marketing yards and preferably facilities for slaughter, meat packaging and utilisation of slaughter house by products in the major sheep rearing tracts, and the organisation of meat marketing through sheep farmers' cooperatives.

Potential for Export and Import Substitution

30.1.68 Foreign exchange worth Rs. 85.4 crores was earned in 1973-74 through export of sheep and sheep products. This constituted 17.4 per cent of the total foreign exchange earnings from all livestock products. The sheep based items which have export potential are wool and woollens, skins, mutton and mutton products, casings and live animals. In the following paragraphs the measures necessary to realise higher export earnings are discussed.

30.1.69 Wools and Woollens : The trends in export-import of wools and woollens during 1969-70 to 1973-74 have been discussed in Chapter 12 on Export Possibilities and Import Substitution. The main features of the export trade are that export of raw wool is showing a progressive decline while the export of woollens is steadily going up. The export of wool till 1966-67 was on an average about 11 million kg. It started declining since 1968-69. It stood at 2.5 million kg during 1971-72 and was of the order of 5.5 million kg in 1973-74. The value of exported woollens rose from Rs. 17.64 crores in 1969-70 to Rs. 45.17 crores in 1973-74. Another important feature of the trend is that the import of fine wool has shown a considerable decrease over the last few years. It has dropped from about 18 million kg in 1969-70 to about 7 million kg in 1973-74. These are healthy trends in export-import of wools and woollens and should be encouraged by progressively restricting export of raw wool and by increasing export of manufactured woollen goods. As far the import of superior quality wool, we expect that the downward trend would continue with the intensification of programmes of fine wool production in the country.

30.1.70 In order to boost the export trade in wools and woollens, it is necessary that the Small Scale Industries Departments in the States should provide some suitable incentives to the wool producers

and to the manufacturers of woollen goods and handwoven carpets. Wool production and manufacture of woollen goods and handwoven carpets should be tied up with the schemes of Handicrafts Boards/ Khadi Board functioning in the areas. The Boards should give expert advice on the types and patterns of goods to be produced and also help in the marketing of products. The woollen exporting units which are basically small scale units suffer from certain financial handicaps. It is difficult for them to pay the high duty (about 50 per cent) and to wait for refund which takes several months. We are of the opinion that the procedure of payments of drawback claims of duty requires to be simplified. Perhaps a substantial portion of the claim, say, about 80 per cent, could be paid within a period of two weeks from the date of export and the balance paid after the claim is fully settled.

30.1.71 Skins : Exports of sheep skins have shown an increasing trend from 1970-71 and the amount of earnings during 1973-74 stood at Rs. 32 crores which is double of what it was three years back. The export value can be considerably increased, if flaying and curing of the skins could be improved and defects arising from shearing cuts and skin wounds could be reduced. We suggest that shearing, flaying and curing should be undertaken only by trained persons. Considerable damage to skins is caused by ecto-parasites which should be controlled by giving dips to sheep at suitable intervals as recommended in paragraph 30.1.55. The present official policy regarding export of raw skins is to regulate their export under a quota system and to encourage the export of tanned, finished leather and leather goods. We endorse this policy as it generates more employment within the country and boosts up foreign exchange earnings.

30.1.72 Mutton, casings and live animals : These items have a tremendous export potential. Apart from frozen meat, export of tinned meat and meat preparations could be explored. Casings are in great demand in foreign markets but due to the insanitary conditions prevailing in most of the Indian slaughter houses their export is dwindling. In 1969-70, eightyone thousand kg of casings were exported, which sharply dropped down to 27 thousand kg in 1973-74. The steps necessary to boost up the export trade in casings have been dealt with in detail in Chapter 36 on Meat Production and Animal By-products. As regards live animals, it may not be desirable to spare a large number of them for export in the near future due to the present internal demand. We expect that India would be in a position to export some improved sheep in coming years and by 2000 AD it may be possible to build a sizeable export trade.

30.1.73 Pelt production : There has been little research and development effort made in exploring possibilities of using indigenous breeds

for pelt production. In pre-partition days there was some production of pelts from fat tail sheep in North Western Frontier Province. Pelts are also known to be produced on a small scale in Rajasthan, primarily from lambs obtained from older ewes either through slaughter in later part of gestation (around 130 days) or from lambs born out of such ewes and slaughtered within a day or two of birth. These pelts are exported mostly as lamb skins but fetch higher prices than ordinary lamb skins. We understand that CSWRI has recently set up a Division of Carpet Wool and Karakul Pelt Production at Bikaner to test the performance of Karakul sheep imported from USSR. It has also been planned to study the possibility of producing pelts from indigenous carpet wool breeds and indigenous \times Karakul crossbreds. The results of these studies may open up possibilities of earning considerable amount of foreign exchange as there is a good export market for pelts.

Need for Increase in Number of Sheep

30.1.74 As stated in paragraph 30.1.11, sheep population showed a slight rising trend from 1951 to 1966 when the number increased from about 39 million to about 42 million. A decline in the number of sheep was observed in the census undertaken in 1972, when the population was found to be about 40 million. This number is absolutely inadequate to meet the present and future requirements of mutton and wool. In the past, due to various financial, physical and technical difficulties, the sheep population could not grow to meet the demand of the country. We expect that with the launching of the sheep development programmes proposed by us, adoption of modern techniques of breeding, improvement in the feed and fodder resources, better management practices and provision of an efficient health coverage, the sheep population will get considerably increased. We recommend that the sheep population should be raised to about 45 million by 1985 and to 60 million by 2000 A.D.

2 GOATS

Introduction

30.2.1 India ranks first among the countries of the world in goat population.¹ According to the 1972 Livestock Census, there were

¹ FAO Production Year Book, 1972, 26, 189--191.

68 million goats in the country constituting about 19 per cent of the total world goat population.¹ Goat contributes about 35 per cent to the total meat and about 3 per cent to the total milk produced in the country. Besides, by export of goat skins, casings and hair valuable foreign exchange is earned. The manure produced from droppings enriches the soil. However, because of its habit of nibbling at young plants and grasses, it can cause immense damage to areas under afforestation. As such, if the economic value of the goat is to be fully exploited, suitable management systems will have to be devised to exercise greater control over their movement and feeding habits. It may also be necessary to reduce their numbers in areas where afforestation, soil conservation and pasture development programmes have been introduced.

Population Trends

30.2.2 The censuses carried out quinquennially during the period 1951 to 1972 showed that the goat population maintained a continuous rising trend. The number of goats increased from 47 million in 1951 to 55 million in 1956 recording an increase of about 17 per cent. The number went up to 60.8 million in 1961 showing a rise of 9.7 per cent over the previous census period. The goat population rose to 64.6 million in 1966 and to 68 million in 1972, thus registering a further rise of 5.8 and 5.3 per cent respectively over the previous censuses.² This steady increase in the number of goats has occurred despite the fact that no special goat development programmes are being pursued and about 36 per cent of the total population of goats is being slaughtered every year. The reason is that very nominal expenditure on their upkeep has to be borne by the goat owners since goats can thrive on shrubs, bushes, thorny vegetation and top feeds of a variety of trees. The number also multiplies fast due to the high incidence of twinning. A study carried out at Hissar Farm showed that the Beetal goats in an average year produced 35 per cent singletons, 54 per cent twins, 6.3 per cent triplets and 0.4 per cent quadruplets. The percentage of twinning in Jamnaparis was found to vary from 19 to 50 with an average of 35 and in Barbaris from 47 to 70 per cent.³

Regional Distribution

30.2.3 Goats are found all over the country. Important breeds in the northern temperate region are Bakarwal, Assam hill, Chamba,

¹ Eleventh All-India Livestock Census, 1972. (Provisional).

² All-India Livestock Census—Seventh to Eleventh.

³ Handbook of Animal Husbandry (1962), Indian Council of Agricultural Research, p. 85.

Gaddi and Gugu. In the north western region Barbari, Beetal, Jamnapari, Kutchi, Marwari, Mehsana, Sirohi and Zalwadi are the important breeds while in the Peninsular region Osmanabadi, Malabari/Tellicherry are found. In the eastern region, black, brown and white Bengal and Ganjam are the important breeds. Of these the Bengal, Sirohi and Barbari are small size breeds while the others are either of medium size or tall, the tallest being Jamnapari.

Goat Rearing Practices

30.2.4 The goats like sheep are hardly provided any housing and it is a usual practice to herd them together in an enclosure along with sheep or separately. In cities they usually share the living quarters of their owners and are hardly ever provided separate shelters. Although no separate study on the migration practices in goat has been carried out, the results of a sample survey on estimation of wool production carried out by the IARS showed that a large percentage of stationary and migratory sheep flocks had also goats which migrated along with sheep. In Andhra Pradesh, Gujarat, Himachal Pradesh, Mysore (Karnataka) and Rajasthan, about 36, 95, 36, 48 and 80 per cent respectively of stationary sheep flocks and about 47, 98, 49, 77 and 78 per cent respectively of migratory sheep flocks were also found to have goats.¹

30.2.5 Goats are generally maintained on browsing and natural grazing and are hardly given any supplementary feed. In big cities, however, goats are generally stall-fed on cultivated fodder, top feed and given some supplementary grains. Goats prefer browsing on small bushes and it is a common practice to lop trees for feeding goats. In some areas, browsing on young plants and reckless lopping of trees for feeding goats has been the principal cause of destruction of natural vegetation and soil erosion. As such it is highly necessary that in areas seriously devastated due to soil erosion and where soil conservation practices are being introduced, goats should be kept out.

Meat Production

30.2.6 Goats are raised mainly for meat. Out of the 355 million kg of meat derived from sheep and goats in 1967-68, 244 million kg was contributed by goats. The number of animals slaughtered was around 27 million which constituted about 36 per cent of total population of goats. Two pilot studies on mutton production carried out by

¹ Sample survey for estimation of wool production (1959-64), Institute of Agricultural Research Statistics (Indian Council of Agricultural Research), New Delhi.

IARS in Tamil Nadu (1966-67) and Haryana (1968-69) indicated that the average yield per animal was of the order of 10.2 and 10.9 kg respectively.¹ Hardly any serious development programmes for improving meat production of goats have so far been undertaken in the country. In the early 1964, the Punjab Government imported under an FAO Project 75 does and 12 bucks of Alpine, Anglo-neubian and Toggenberg breeds for introduction in their Intensive Agricultural Development Block in Ludhiana district. A small attempt at crossbreeding Beetal with Alpine and Anglo-neubian was also made at the Haryana Agricultural University, Hissar. The preliminary results showed that Alpine crosses matured earlier and produced relatively larger quantities of milk. There was, however, little improvement in bodyweight, efficiency of feed conversion for meat and dressing percentage. In the case of goats, no exotic germplasm is available for increasing the yield of meat since superior goat breeds found in foreign countries are essentially dairy breeds. Consequently, the approach for raising meat production from goats should be selective breeding among taller and medium sized breeds and outcrossing the non-descript types with selected meaty type bucks. In addition proper management, fattening rations and better health cover should be provided.

Milk Production

30.2.7 According to the production estimates of milk in 1971-72 goats produced about 675 thousand tonnes of milk constituting 3 per cent of the total milk produced in the country. Some selective breeding was carried out for over 35 years in Beetal goats at the Government Livestock Farm, Hissar. The results indicated a slight genetic deterioration. Similarly selective breeding trials carried out with Jamnapari and Barbari goats at the State Government farms in Uttar Pradesh did not show any appreciable improvement in milk production. Limited studies carried out in crossbreeding Beetal goats with Alpine and Anglo-neubian at the Haryana Agricultural University, Hissar showed improvement in milk yield and decline in age at first kidding and increase in milk production in halfbreeds. We, therefore, recommend that for increasing milk production of goats crossbreeding with exotic dairy breeds may be undertaken and milk capabilities of better indigenous dairy breeds like Jamnapari, Barbari and Beetal should be improved through selective breeding. This would require production of stud bucks for which some goat breeding farms should be set up and progeny testing work undertaken. In addition, bucks from high producing dams in flocks of progressive goat breeders may

¹ Mutton Production (1967-68) —Agricultural Marketing in India, 1970.

be selected and distributed among goat farmers. The progressive goat breeders may be advised to maintain milk records and other relevant information that may be helpful in selecting prospective bucks.

Pashmina and Mohair Production

30.2.8 Production of Pashmina is confined to Ladakh and its annual production has been estimated to be of the order of 41,000 kg. Mohair is produced in very small quantities in Garhwal (Uttar Pradesh) and Himachal Pradesh. Both Pashmina and Mohair are in great demand in cottage industry and in the foreign markets. The outturn of wool from the indigenous pashmina goat is about four ounces. In quality it is quite comparable with Pashmina from exotic goats but the yield per animal in the country is very poor. The ICAR has initiated an All-India Coordinated Research Project for developing a strain of high Pashmina producing goats by crossing Tibetan Pashmina goats with exotic Pashmina goats to be imported from Russia. This work should be pursued vigorously.

30.2.9 Mohair gives about three times more profit than wool. Crossbreeding experiments for mohair production carried out at Pipal-koti indicated the possibility of evolving breeds capable of producing high quality mohair. An All-India Coordinated Research Project for evolving such breeds by crossing with Angora is in progress in U.P. and Maharashtra. We are informed that the results obtained are very encouraging and the production of mohair has increased. Field programmes to take up production of mohair by crossing hairy breeds with Angora in cold arid areas should now be initiated.

Need for Reduction in Number of Goats

30.2.10 As already stated in paragraph 30.2.2, an analysis of the trend of goat population over the period 1951 to 1972 has shown an enormous progressive increase in the goat population. While the goat population in 1951 was 47 million, it was as high as 68 million in 1972. As stated in paragraph 9.51 of the Interim Report on Desert Development the trend of increase in goat population particularly in desert areas is disturbing. This can produce a devastating effect on vegetation due to browsing habits of goats. The sheep and goat owners should, therefore, be educated on the advisability of reducing the number of goats and improving their quality as recommended by us in paragraph 9.51 of the Interim Report on Desert Development. Further, restrictions on grazing of goats on specially developed grasslands should be imposed. At the present rate of growth the number of goats

is likely to be of the order of 70, 74, 78 and 90 million in 1975, 1980, 1985 and 2000 respectively. It may not be possible to arrest their number in the normal course upto 1980. But we definitely feel that the slaughter of goats for meat purposes should be increased so that the rate of growth of population of goats may come down to a level of 67 million by 1985 and get stabilised at about 40 million by 2000 AD. We expect that by then the quality of sheep would get considerably improved, yielding higher quantity and better quality of wool and mutton. The surplus stock of goats likely to be made available for slaughter would be of the order of 10.7 million and 50 million in 1985 and 2000 AD. Assuming even 10 kg as the average dressed carcass weight, the meat from surplus stock would come to about 107 and 500 million kg in 1985 and 2000 AD respectively. This would to some extent relieve the acute shortage of meat and make available some meat for export.

3 SUMMARY OF RECOMMENDATIONS

30.3.1 The following is a summary of the important recommendations made in the text of this chapter :

Sheep

1. The State Animal Husbandry/Sheep Husbandry Department should set up service centres on the sheep migration routes.

(Paragraph 30.1.6)

2. Cheap houses with thatched roofs made of locally available material and thorny fences should be provided to give shelter to sheep flocks, particularly to young lambs, pregnant ewes and breeding rams. In areas normally experiencing extreme cold or hot winds, some protection against the winds should also be provided.

(Paragraph 30.1.8)

3. The ICAR and agricultural universities should initiate studies on the economics of supplemental feeding of sheep during growing stages, breeding seasons, later part of gestation, lactation etc.

(Paragraph 30.1.9)

4. From the next census onwards, breakup figures in respect of different categories like ewes, rams and young of the exotic, crossbred and indigenous stock should be collected on a sample basis.

(Paragraph 30.1.11)

5. The sampling design formulated by the Institute of Agricultural

Research Statistics should be used by the States for estimation of wool production.

(Paragraph 30.1.14)

6. Every effort should be made to fully develop within the shortest possible time the State Sheep Breeding Farms started during the Fourth Plan, as these Farms are to play a very important role in sheep development programmes through the supply of superior germplasm.

(Paragraph 30.1.19)

7. Sheep to be imported should come from the regions having more or less the same type of climate that prevails in the areas where they are to be stationed in the country.

(Paragraph 30.1.21)

8. Sheep for import should be selected from as large a number of flocks as possible to ensure greater genetic variability.

(Paragraph 30.1.21)

9. The level of exotic fine wool inheritance should be stabilised around 50 per cent in arid and semi-arid areas and the crossing of exotic fine wool breeds with black faced indigenous breeds should be avoided.

(Paragraph 30.1.29)

10. Since the All-India Coordinated Research Project on Sheep Breeding is of great importance, necessary steps to remove bottlenecks for its expeditious execution should be taken.

(Paragraph 30.1.30)

11. The total sheep population in Jammu & Kashmir, Himachal Pradesh, hilly regions of Uttar Pradesh, sheep of Chokla and Nali breeds in Rajasthan, Nali sheep in Haryana, Pattanwadi sheep in Gujarat, Nilgiri sheep of Nilgiri hills in Tamil Nadu and better type of wool sheep in Arunachal Pradesh may be brought under crossbreeding for fine wool production using Rambouillet and/or Merinos.

(Paragraph 30.1.31)

12. Selective breeding among sheep of important carpet wool breeds in Rajasthan such as Marwari, Jaisalmeri, Pugal and Magra and among Marwari and other woolly sheep except Pattanwadi in Gujarat should be undertaken.

(Paragraph 30.1.36)

13. A few large sheep breeding farms of Marwari, Jaisalmeri, Pugal and Magra breeds should be established in their respective home tracts.

(Paragraph 30.1.36)

14. Since Indian carpet wools lack lustre, improvement through selection or through crossing with carpet wool breeds from some middle eastern countries which produce lustrous wool may be undertaken by

the ICAR on experimental basis.

(Paragraph 30.1.36)

15. In view of great potentiality for export of mutton, work on evaluation of carcass quality, laboratory evaluation of meat quality and meat processing should be initiated on priority basis at the CSWRI, IVRI and in agricultural universities.

(Paragraph 30.1.38)

16. The population of woolly type sheep in Haryana, Punjab, western Uttar Pradesh, Rajasthan, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu and Bihar should be crossed with exotic dual purpose breed like Corriedale to evolve a dual purpose breed for producing better carpet quality wool, better liveweight and higher dressing percentage.

(Paragraph 30.1.39)

17. The hairy breeds other than Mandya and Nellore should be graded up with Nellore and Mandya. In Mandya and Nellore selective breeding based on six monthly body weight should be practised.

(Paragraph 30.1.40)

18. It would be advisable to establish four large exotic sheep breeding farms in different regions of the country for undertaking crossbreeding with Corriedale.

(Paragraph 30.1.41)

19. In view of the large scale crossbreeding programmes that are to be undertaken for rapid increase in wool and mutton production, serious attempts should be made to try out the technique of artificial insemination (AI) in the breeding of sheep.

(Paragraph 30.1.45)

20. In Rajasthan some flockowners have been trained in detection of oestrus in ewes and for practising AI in sheep flocks. This practice should be tried on an experimental basis in other important sheep rearing States.

(Paragraph 30.1.45)

21. For meeting the nutritional requirements of sheep to express their genetic potential for wool/meat production, the greater part of arid region which is suitable only for livestock farming should be utilised more profitably for range land and pasture development.

(Paragraph 30.1.47)

22. The development of village grazing lands should be entrusted to the village panchayats or Sheep Breeders' Cooperatives.

(Paragraph 30.1.47)

23. Improvement of natural pastures in States like Himachal Pradesh, Jammu & Kashmir and hilly areas/regions of Uttar Pradesh & southern States should be undertaken. Large blocks of Government

range lands located far away from villages should be developed mainly as grass reserves for hay making.

(Paragraph 30.1.48)

24. Fodder crops, especially leguminous fodders, should be included in the cropping pattern in irrigated areas.

(Paragraph 30.1.48)

25. There is an urgent need to carry out survey on the micro-nutrient (sulphur, cobalt, copper and zinc) status of soils and plants including fodder and their availability to sheep in areas of intensive sheep rearing and investigate the effects of their absence.

(Paragraph 30.1.49)

26. The feed compounding industry should manufacture cheap supplementary rations for sheep, utilising agricultural and industrial wastes and nonprotein nitrogenous substances.

(Paragraph 30.1.51)

27. The extension veterinarians should visit the sheep flocks frequently for undertaking vaccination against sheep pox, enterotoxaemia etc. and for periodic drenching of sheep with anthelmintics and for arranging sheep dips.

(Paragraph 30.1.52)

28. The IVRI should undertake large scale manufacture of the irradiated vaccine against lung worm infestation for field use.

(Paragraph 30.1.52)

29. The Animal Husbandry Division of the Union Ministry of Agriculture and Irrigation should lay down a policy for eradication of blue tongue which at present is confined to a small area.

(Paragraph 30.1.53)

30. The IVRI should initiate research work on blue tongue and should keep itself in readiness to start the manufacture of blue tongue virus vaccine.

(Paragraph 30.1.53)

31. A systematic survey to determine the incidence of infectious epididymitis/orchitis at the different sheep farms in the country should be undertaken. The epizootiology, pathology and pathogenesis of the disease should be studied and suitable preventive measures against the disease should be devised for the guidance of breeding farms.

(Paragraph 30.1.54)

32. The IVRI and agricultural universities should carry out detailed studies on the pathology and pathogenesis of pneumonitis in sheep with a view to devising suitable preventive measures.

(Paragraph 30.1.55)

33. Shearing should be done twice a year, as once a year shearing causes problems of wool shedding and skin diseases while thrice a

year shearing reduces staple length.

(Paragraph 30.1.56)

34. The Sheep and Wool Extension Agencies of the State Animal Husbandry/Sheep Husbandry Department should educate the sheep farmers regarding improved shearing practices.

(Paragraph 30.1.57)

35. The present wool grading system is very cumbersome and should be revised to have lesser number of grades.

(Paragraph 30.1.59)

36. A Central Wool Testing Laboratory should be set up in all the important wool producing States to provide wool testing service.

(Paragraph 30.1.59)

37. The State Governments should enact legislation to ensure that all the wool produced in the State is passed through the grading centres.

(Paragraph 30.1.60)

38. The grading and marketing of wool should not be the responsibility of the State Animal Husbandry or Sheep Husbandry Department. These Departments should primarily concentrate on sheep development activities.

(Paragraph 30.1.60)

39. It is necessary to have organised wool markets by making provision of Agricultural Produce (Grading and Marking) Act applicable to wool in the important wool producing States.

(Paragraph 30.1.62)

40. Wool marketing in important wool producing States should be properly organised either through Sheep Farmers' Cooperatives or through statutory Wool Boards, which should take up the responsibility of sheep shearing, wool grading, warehousing and marketing wool.

(Paragraphs 30.1.64 & 30.1.66)

41. Marketing yards for the sale of live animals preferably with facilities for slaughter, meat packaging and utilisation of slaughter house byproducts should be set up in the major sheep rearing tracts.

(Paragraph 30.1.67)

42. Progressive restrictions on export of raw wool should be placed and export of manufactured woollen goods should be encouraged.

(Paragraph 30.1.69)

43. Wool production and manufacture of woollen goods and hand-woven carpets should be tied up with the schemes of Handicrafts Boards/Khadi Boards functioning in the area.

(Paragraph 30.1.70)

44. The procedure of payments of drawback claims of duty on woollen goods for export should be simplified.

(Paragraph 30.1.70)

45. Shearing, flaying and curing of hides should be undertaken only by trained persons.

(Paragraph 30.1.71)

46. The sheep population should be raised to about 45 million by 1985 and to about 60 million by 2000 A.D.

(Paragraph 30.1.74)

Goats

47. Approach for raising meat production from goats should be selective breeding among taller and medium sized breeds and out-crossing the non-descript type with selected meat type bucks.

(Paragraph 30.2.6)

48. Crossbreeding with exotic dairy breeds of goats may be undertaken for increasing milk production.

(Paragraph 30.2.7)

49. Milk capabilities of better indigenous dairy breeds like Jamnapari, Barbari and Beetal should be improved through selective breeding. For production of stud bucks some goat breeding farms should be set up and progeny testing work undertaken.

(Paragraph 30.2.7)

50. Bucks from high producing dams in flocks of progressive goat breeders may be selected and distributed among goat farmers.

(Paragraph 30.2.7)

51. Progressive goat breeders may be advised to maintain milk records and other relevant information that may be helpful in selecting prospective stud bucks.

(Paragraph 30.2.7)

52. Work on All-India Coordinated Project for developing a strain of high pashmina producing goats should be pursued vigorously.

(Paragraph 30.2.8)

53. Field programmes to take up production of mohair by crossing hairy breeds of goats with Angora in cold arid areas should be initiated.

(Paragraph 30.2.9)

54. Slaughter of goats for meat purposes should be increased so that the rate of growth of population may come down to a level of 67 million by 1985 and go down to about 40 million by 2000 AD.

(Paragraph 30.2.10)

POULTRY

1 INTRODUCTION

31.1.1 Poultry farming is possible in widely differing agroclimatic environment as the fowl possesses marked physiological adaptability. Requirements of small space, low capital investment, quick returns from outlay and well distributed turnover throughout the year make poultry farming remunerative in both rural and urban areas. The rearing of poultry provides an excellent opportunity for gainful employment to idle or underemployed members of rural families because of the ease with which poultry can be handled even by women and children. Amongst farm animals, poultry is one of the quickest and most efficient converters of plant products into food of high biological value. Poultry litter, if properly collected, as in the deep litter system, has a high manurial value. Its quality and amount are claimed to be sufficient to raise additional grains and byproducts to feed the same birds¹.

31.1.2 Even two decades ago, there was lack of adequate appreciation of the possible multiple benefits from poultry farming. Before the advent of the Plan era, commercial poultry production was practically non-existent. Poultry farming was then fairly extensive but limited to backyard poultry keeping with low productive *desi* fowls maintained under peasant husbandry practices. The benefits derived were, therefore, only a small fraction of what could be obtained from scientific poultry farming. Superior exotic poultry breeds with high egg productivity were introduced in the country from time to time for improving the indigenous stock but in the absence of a systematic large-scale development programme such efforts proved abortive. During the last decade, a rapid development of poultry industry has taken place. It appears that as a result of organised and concerted efforts made under poultry development plans on a countrywide scale, a firm base has been laid and poultry farming has established itself in India as a profitable commercial enterprise.

¹ Mc Ardle, A.A. and Panda, J.N. 1964. Fertiliser from your poultry birds. Indian Fmg. 13 (10): 3.

2 POULTRY STATISTICS

31.2.1 Systematic enumeration of poultry population on all-India basis was first attempted in 1940, with the inclusion of fowls and ducks in the livestock census. Data obtained from this and the 1945 censuses were of little value for planning on an all-India basis because of incomplete coverage and absence of classification. The situation remained the same till 1961, the terminal year of the Second Plan period, when a beginning was made to classify the poultry population in the livestock census under three broad heads, viz., *desi* fowls and 'improved' fowls and ducks and others. This classification was, however, adopted only in a few States. It was during the next census in 1966, that all the States except Nagaland followed this classification. Even then, more detailed information is necessary for better and effective planning. For instance, there is no sexwise classification of poultry in the census. Also no breedwise breakdown of the 'improved' fowl is available.

31.2.2 Information on egg or poultry meat production is incomplete. The Report on Marketing of Eggs (1938) by the Directorate of Marketing and Inspection (DMI), Government of India indicated for the first time the extent of production of eggs in the country. According to that report, egg production was of the order of 3,315 million, and the estimated production per bird per year was 53 eggs and per capita availability 8 eggs per annum. The Second Report of the DMI published in 1955, was based on the 1951 livestock census and provided some information on per capita consumption of poultry meat in different urban and rural areas. Wide variations in poultry meat consumption were observed according to areas and seasons. The average per capita consumption was only 0.13 kg per annum.

31.2.3 The surveys by the DMI were not based on sound statistical methods as the methodology of such surveys was not sufficiently developed at that time. Even though not very reliable, in the absence of any other information, these estimates had to be used for the preparation of poultry development programmes during the early five year plans.

31.2.4 To evolve suitable methodology for obtaining fairly precise and dependable estimates on poultry population, production and per capita availability of products and to obtain information on poultry keeping practices, various sample survey studies were carried out by the Institute of Agricultural Research Statistics (IARS), Indian Statistical Institute and the National Sample Survey Organisation (NSS).

Following these surveys, methods have been evolved for obtaining estimates of poultry production and poultry population during intercensus periods with reasonable degree of precision. Steps are now being taken to adopt these procedures. Estimation of population and production during intercensus period is of particular importance in case of poultry. This is because the productive life of poultry is 2-3 years, whereas, the census is held after every five years. Commercial layers are in fact kept only for a year or a year and a half at the most and broilers are retained only for 8-10 weeks.

31.2.5 With a view to collecting more useful and reliable information for the purpose of preparing more effective and realistic poultry development plans, we recommend that the following steps should be taken at an early date :

- (i) During livestock census, sexwise classification of the poultry population and breedwise breakdown of improved fowls should be made on sampling basis.
- (ii) The IARS, Indian Statistical Institute and the NSS should continue and expand their researches on the methodology of obtaining reliable information on the varieties of birds (pullets, layers, broilers etc.) maintained in the farms, size of farm operation, and the husbandry practices followed, and other aspects of farm economics and management. Research studies should also aim at improving the methods already developed.
- (iii) The existing organisations for livestock statistics in different States should be strengthened for conducting regular, periodic intercensus sample surveys for estimation of poultry population and production and collection of information on farm management following the methods evolved through studies mentioned under item (ii) above. If such an organisation is not there in a State, immediate steps should be taken to establish one.
- (iv) The existing Livestock Statistical Cell in the Animal Husbandry Division of the Union Ministry of Agriculture and Irrigation should also be strengthened to enable it to effect suitable coordination and provide more effective guidance to the activities of the State organisations.

3 DEVELOPMENT OF POULTRY FARMING

Pre Second World War Period

31.3.1 The promising state of poultry production today is not a

sudden occurrence though an impressive growth has taken place only during the last decade or so. The development however, occurred in distinct stages. In fairness, the credit for pioneering action for poultry development should be given to a few christian missionary organisations. These organisations imported for the first time superior exotic breeds of poultry in the country towards the end of the 19th century. The objective was to establish their own poultry farms and to make cocks available to the neighbouring farmers for crossing and improving the indigenous stock. The farmers appreciated the help of the missionaries in Etah (Uttar Pradesh), Katpadi (Tamil Nadu) and Martendum (Kerala). These activities created amongst them some awareness of the advantage of raising better quality fowls.

31.3.2 Another event of great significance for poultry development in the country was the establishment in 1938 of the Poultry Research Division at the Indian Veterinary Research Institute (IVRI)*. The Poultry farm of the Division could maintain 4,000 layers and had facilities for hatching, brooding and rearing of birds. The farm was stocked with exotic breeds like White Leghorn, Rhode Island Red, Australorps, Black Minorca, New Hampshire, Light Sussex etc. The breeding programme in the early stages was limited to multiplication of pure stock and some crossbreeding for improved egg production. The IVRI also supplied hatching eggs to the neighbouring villagers for obtaining better quality chickens and made available cockerels of improved breeds to poultry farmers for mating the indigenous stock owned by them. These steps taken by the IVRI generated considerable amount of interest. Possibly the most important single contribution of the IVRI for poultry development in India was the evolution in 1942, of an effective vaccine against Ranikhet disease by its Pathology and Bacteriology Division. This disease was the greatest obstacle to successful poultry farming in the country. Because of these developments a number of model poultry farms were established in the forties by different State Governments for demonstration, training and multiplication of improved poultry stock. Most of the States appointed Poultry Development Officers to promote poultry production. With financial assistance extended by the ICAR, a cadre of Poultry Disease Investigation Officers was created in a number of States. As interest in poultry production was growing, the ICAR sponsored research projects on poultry at the IVRI and in some of the States. In keeping with these developments, the IVRI initiated post-graduate training programmes in poultry science for State Animal Husbandry Officers.

31.3.3 During the Second World War, the demand of the army for

*Then designated Imperial Veterinary Research Institute.

eggs and table birds increased manifold. To meet this demand the military authorities set up 10 poultry farms with improved exotic stock each of 10,000 bird capacity. From time to time some poultry stock and eggs for hatching were distributed by the military poultry farms to the neighbouring farmers for raising poultry stock of improved variety. These steps helped popularise the rearing of better quality poultry stock amongst small sections of rural people.

31.3.4 The cumulative effect of these different activities was a greater appreciation by the Central and State Governments of the possible advantages of poultry development. The demonstration and extension work carried out by the different poultry farms in the States, created interest among farmers in localised rural areas in rearing poultry of superior quality as a subsidiary occupation for economic benefit. Organisation of Poultry Shows along with Cattle Shows also popularised poultry rearing and created enthusiasm among poultry breeders.

Post Second World War Period

31.3.5 As part of the post war developmental programmes a few officers from the IVRI, State Departments and other organisations were sent abroad for advance studies in poultry science. The education and training of a number of those officers proved beneficial for poultry development work initiated after Independence.

31.3.6 The foundation on which poultry farming grew in India was truly laid in the fifties with the advent of the five year plans. Prior to the Plan era, the ICAR and some of the State Governments had initiated a few poultry breeding research programmes as part of the 'Grow More Food Campaign'. Under the First Plan, an All-India Poultry Development Programme aiming at establishment of Poultry Extension-cum-Demonstration Centres was launched. A beginning was made with 33 centres having facilities of poultry houses and staff under the State Animal Husbandry Departments. Some State Government poultry farms were also strengthened to take up a programme of large-scale multiplication and acclimatisation of exotic stock and subsequent propagation. The scope of the programme was enlarged during the Second Plan by establishing five Regional Central Government Poultry Farms. Substantial aid was received from the US Technical Cooperation Mission (TCM) which supplied 30,000 day-old chicks of White Leghorn, Rhode Island Red breeds and poultry equipment. The TCM chicks were distributed among the Central and State Government poultry farms to augment substantially the breeding programmes that were already in progress. As a

result, the number of the Poultry Extension-cum-Demonstration Centres was increased about tenfold. These Centres, each with 100 layers of improved breeds, were set up to: (a) demonstrate the modern methods of poultry keeping and the economic benefits obtainable from poultry farming with improved varieties of birds; (b) impart training to the farmers in raising of poultry starting from day-old chicks to the layer stage; (c) supply hatching eggs, day-old chicks, adult birds, poultry equipment and construction material at subsidised rates or free of cost in some cases, to start small poultry units; and (d) provide custom hatching facilities. Trained Extension Officers were attached to these Centres to make available technical knowhow to the farmers on a continuous basis. All these steps taken during the Second Plan period made a substantial contribution to the development of poultry production. Awareness was created amongst the farmers about the role scientific poultry farming could play in improving their economy.

31.3.7 Sixties proved to be the turning point in the history of poultry production in the country. It is during this period that poultry farming was accepted as a source of livelihood. The concept of backyard poultry keeping yielded place to poultry farming as a commercial enterprise. Initiation of an Intensive Egg and Poultry Production-cum-Marketing Programme, popularly known as the Intensive Poultry Development Project (IPDP), with an area development and package approach, was the most important factor for bringing about this favourable development. Introduction of deep litter system of management and further importation of high quality stock and mass preventive vaccination against common avian diseases, income tax exemption for the poultry sector in agriculture, progressive industrialisation with resultant higher purchasing power of people, were among other major contributing factors.

31.3.8 Intensive Egg and Poultry Production-cum-Marketing Centres were established in selected urban areas in different States. Encouraged by the progress achieved under the project, the State Governments decided on a more ambitious programme and extended the area of operation to 81 other centres. Under this programme all the required inputs and services such as good quality birds and equipment, training of farmers, effective disease control measures and improved management knowhow were made available to 300 farmers per centre helping them to have poultry units of 100 layers each. Besides, facilities were provided to market their outputs with an assured and a reasonable margin of profit.

31.3.9 As a consequence of the concerted drive, poultry production started increasing and gaining momentum. In order to ensure that

the momentum was maintained private entrepreneurs were encouraged to establish franchise hatcheries of foreign based poultry breeding organisations for production and supply of high egg producing hybrid chicks. Anticipating that with increased egg production there was a possibility of seasonal surplus the establishment of a dehydration plant at Tiruvella, Kerala for egg powder was sanctioned. The project was, however, ultimately abandoned. Essential facilities for broiler production were also created. To process large number of broiler chickens quickly, several dressing plants of different capacities were established at various places. Some commercial hatcheries started disseminating special meatline chicks with qualities for rapid growth and high feed conversion efficiency. Feed manufacturing units in private, public and cooperative sectors started getting established. These units made good commercial feeds available to the poultry farmers. Some private feed manufacturers put out in the market special broiler mash. The organisation to provide health cover to the poultry farms was strengthened.

31.3.10 Scientific poultry breeding programmes were launched during this period in the Central poultry farms as the first step towards attaining self sufficiency in the production and supply of high quality chicks. The training programme for the farmers was extended. Financial assistance for supply of poultry house materials and rearing equipment at concessional rates and for subsidy for purchase of incubators was extended. Sizeable international assistance was available during this period for promotion of poultry development.

31.3.11 Poultry farming had become an economic enterprise during the sixties. This led to the establishment of a very large number of farms with layer strength ranging from 500 to 50,000 in various parts of the country, especially near towns and cities and industrial complexes, for operation on commercial lines. To satisfy the needs of growing poultry enterprises the equipment manufacturers came forward to fabricate various types of poultry equipment.

31.3.12 During the Fourth Plan period, poultry production continued to progress satisfactorily. To give additional support to the training programme a High Level Inservice Training Institute* was established at Hessarghatta near Bangalore. The selective breeding programme initiated earlier at the Central poultry farms was modified and a co-ordinated poultry breeding project (CPBP) was launched in which three Central and a number of selected State poultry breeding farms participated. The IPDP was further enlarged. Poultry disease control measures and disease diagnostic services were strengthened

*Now redesignated as the Central Training Institute for Poultry Production and Management (CTIP P&M).

and mobile veterinary clinics were established. During this period the Central Government launched a special project (SFDA/MFAL) to help the small and marginal farmers and agricultural labourers. Poultry development formed an important component of this project.

31.3.13 It was apparent that as a result of the drive for poultry development under the five year plans, poultry production was making substantial progress. But dependable quantitative criteria are yet to be evolved for objective evaluation of the progress achieved from time to time. It has been indicated in paragraph 31.2.1 that poultry population estimates in the livestock census have started becoming somewhat useful for planning purposes only from 1966 onward. Even accepting the limitations of the available statistics, an analysis of poultry population data (Table 31.1) obtained during the 1966 and the subsequent 1972 census (census due in 1971 was held in abeyance for a year) is of interest and useful.

TABLE 31.1
Poultry Population (Statewise) in 1966 and 1972¹

States	(in thousand)			
			Increase or	decrease
	1966	1972	Numbers	Per cent- age w.r.t. 1966
1	2	3	(col. 3-2)	4
Andhra Pradesh	14,715	19,047	(+)4,332	(+)29.4
Assam	8,936	7,732	(-)-1,204	(-)-13.5
Bihar	10,850	12,560	(+)1,710	(+)15.8
Gujarat	2,325	2,736	(+)411	(+)17.7
Haryana	479	963	(+)484	(+)101.0
Himachal Pradesh	206	189	(-)-17	(-)-8.2
Jammu & Kashmir	1,535	1,654	(+)119	(+)7.7
Karnataka	8,277	10,315	(+)2,038	(+)24.6
Kerala	9,909	12,207	(+)2,298	(+)23.2
Madhya Pradesh	5,739	6,701	(+)962	(+)16.8
Maharashtra	9,902	12,217	(+)2,315	(+)23.4
Manipur	623	938	(+)315	(+)50.6
Meghalaya	943	975	(+)32	(+)3.4
Nagaland	438	703	(+)265	(+)60.5
Orissa	7,698	8,452	(+)754	(+)9.8
Punjab	1,680	3,170	(+)1,490	(+)88.7
Rajasthan	865	1,235	(+)370	(+)42.8
Tamil Nadu	11,226	13,336	(+)2,110	(+)18.8
Tripura	663	518	(-)-145	(-)-21.9
Uttar Pradesh	3,771	3,983	(+)212	(+)5.6
West Bengal	12,818	15,401	(+)2,583	(+)20.1
*Union Territories	1,847	1,736	(-)-111	(-)-6.0
total	1,15,445	1,36,768	(+)21,323	(+)18.5

¹ All India Livestock Census, 1972, New Delhi. Directorate of Economics and Statistics, Ministry of Agriculture and Irrigation, Government of India.

*Excluding Arunachal Pradesh.

The table shows an increase of 18.5 per cent or 21 million in poultry population in 6 years. All the States except Assam, Himachal Pradesh, Tripura and the Union Territories (excluding Arunachal Pradesh where no census was held) registered increases in poultry population in 1972, varying from 3.4 to 101 per cent. The high increase in Haryana (101 per cent), Punjab (88.7 per cent), Nagaland (60.5 per cent), Manipur (50.6 per cent) and Rajasthan (42.8 per cent) was the result of Government's keen interest in popularising poultry farming through propaganda, training of farmers and by providing loans and subsidies for poultry production.

31.3.14 The change in the proportion of the indigenous to the improved fowls is of particular interest. In the 1961 census, *desi* fowl constituted 90.84 million and the improved ones 4.95 million. The corresponding figures in 1966 were 92.65 million and 9.86 million showing almost doubling of improved varieties. Corresponding figures for 1972 are not yet available.

31.3.15 A target of egg production in 1978-79 has been fixed at 11,583.4 million by the Planning Commission. We have made an estimate of the demand for eggs in 1985 and 2000 AD keeping in view the likely trend in growth of income, income elasticity of demand and growth of human population. According to this estimate, the aggregate consumer demand of 6,040 million eggs for the base year 1971 will rise to 10,217 and 15,972 million eggs per annum in 1985 for low and high demands respectively. The aggregate consumer demand in 2000 AD will range between 17,419 and 28,513 million eggs on the two assumptions of growth in per capita private consumption expenditure viz. one per cent per annum and two per cent per annum respectively for the low and high consumer demands. Besides production of eggs, poultry farming has to strive for broiler production. It is reported that during 1973-74 four million broiler chicks were sold by the commercial hatcheries. According to an estimate by some poultry specialists, the number of broilers expected to be produced in 1985 is 17.2 million and this would go up to 71.80 million at the end of the century. If the estimated targets of egg and table bird production are to be achieved, there cannot be any slackening in the poultry development programmes. For attainment of higher production from poultry, the developmental programmes must include a sound and effective poultry breeding strategy for developing strains of chicken genetically capable of higher egg and meat production.

4 BREEDING

31.4.1 The indigenous stock of poultry in the country is mostly of

nondescript type with extremely poor productivity. The average production by a *desi* hen is around 50 eggs in a year in contrast to over 200 eggs a year by the imported White Leghorn breed. Eggs from *desi* hens are much smaller in size weighing, on an average, about 30 g as compared to about 55 g from exotic breeds. One year old *desi* fowl weighs about 1.3 Kg, whereas a broiler of only 8—10 weeks produced from improved exotic breeds of poultry attains this body weight or even excels it. Indigenous fowls have developed through natural selection an adaptability to adverse conditions. They are thus able to meet nutritional requirements largely by foraging, resist diseases, escape attacks from predators and survive and reproduce under adverse environments.

31.4.2 With the backyard poultry keeping prevalent as almost the only method of production before the plan era, there was no systematic and organised breeding programme for genetic improvement of the stock. The possibilities of utilising breeding as a tool for production of commercially viable stock were not fully realised at that time. The breeding programmes followed at the IVRI and the State poultry farms were thus not inadequate for the needs then existing.

31.4.3 The poultry breeding work for grading up *desi* poultry in village homes through supply of cockerels of improved breeds failed to create as much impact as it possibly could have because of the difficulties mentioned below. For implementing the programmes, the cocks of the indigenous stock were to be exchanged with cocks of improved varieties. In many cases, however, this exchange could not be effectively practised. Furthermore, even though a whole village was taken as one unit for operation of such schemes, there always remained some non-participating poultry farmers in the village. As a result *desi* cocks that were not exchanged and those belonging to non-participating villagers were left to freely mate with *desi* hens. This to a great extent nullified the work of grading up of *desi* stock. Moreover, those who participated failed to make husbandry practices and rearing conditions congenial to the improved varieties, in spite of the extension officers' advice and guidance. The result was, that many of the farm reared cockerels failed to adapt themselves to the poor husbandry practices in the villages and either died of disease or fell an easy prey to the predators. Lack of replacement of the *desi* cocks and non-hardening of improved cocks at the rearing farms before release in villages were additional reasons for the poor results obtained from the programmes. Valuable experience was, however, gained which proved useful in formulating future programmes.

Franchise Hatcheries

31.4.4 The foundation of commercial poultry production based on scientific poultry breeding can be said to have been laid in India only as recently as the sixties. It is during that period that some enthusiastic private entrepreneurs established franchise hatcheries of foreign based poultry breeding organisations for commercial mass production of genetically superior hybrid chicks claimed to have potentialities of laying 230—250 eggs a year. As a result of this enterprise, superior quality hybrid chicks with excellent egg laying potentiality became available in the country in large numbers. Because of increasing demands for high egg producing hybrid chicks the franchise hatcheries disseminated the superior stock through their associate hatcheries set up in different parts of the country. These ventures were useful for immediate growth of poultry farming though in the long run these are not conducive to the growth of the industry.

31.4.5 The franchise hatcheries and their associates are at present merely functioning as multiplication centres for producing hybrid chicks out of parent/grand parent stock supplied by the foreign-based breeding organisations. The basic genetic material (pure line stock), however, is entirely in the hands of the breeding organisations abroad and remains an exclusive preserve of the principals of the franchise hatcheries. The terms of Agreement for operation of the franchise hatcheries in the country are such that they are completely dependent on their principals and are required to import periodically grand parent/parent stock for production of commercial chicks. Such Agreements involve foreign exchange commitment on a continuous basis. Moreover, it cannot be in the country's interest to have this flourishing industry so dependent on foreign agencies for supply of source material for its very existence. Due to changed political relations, foreign trade policies, international monetary position, transport restrictions, tariffs etc. there may be long interruption or complete stoppage of supply of grand parent/parent stock of hybrid chicks. Such an eventuality would be ruinous for the poultry industry that has developed only recently and is still growing fast in the country.

31.4.6 We note with satisfaction that the Central Government have decided not to allow any new collaboration projects with foreign organisations for establishment of franchise hatcheries. Three poultry breeding organisations have been established in the private sector with agreements for supply of original breeding lines from foreign based breeding farms in place of supply of parent/grand parent stock. The stock for these breeding farms have come from three sources,

viz., the USA, Czechoslovakia and Israel. The existing hatcheries are also being advised to persuade their principals to supply pureline stock in preference to parent and grand-parent stocks.

31.4.7 As a further step towards attaining self-sufficiency in the matter of supply of high quality commercial hybrid chicks the Central Government have rightly taken a decision to put a ban on importation of exotic stock for commercial production of hybrid chicks. Import of exotic stock of poultry will, however, be permitted for research and developmental work. This decision is in the right direction. Presumably the Central Government had made certain that production of high quality commercial hybrid chicks in adequate numbers out of stocks developed indigenously, both through public and private sectors, was fully assured. The quality of the hybrid chicks to be produced should be of a standard equal to or better than that achieved by the existing franchise hatcheries in India. The hatcheries producing the chicks must also have efficient organisation to maintain or improve upon the high standard reached. A premature ban on importation of exotic stock with consequent fall of standard in the quality of commercial hybrid chicks may cause serious setback to the developing poultry industry. The importation of stock for research and development should be allowed by the Government on recommendation of a standing committee on poultry development about which we have discussed in greater detail in paragraph 31.4.35.

Evolving Strains within the Country

31.4.8 In the foregoing paragraph, we have drawn attention to the need of production of hybrid chicks out of stock developed in the country. This is all the more necessary, as the basic stock developed by the foreign-based breeding organisations are always bred and maintained under much superior management conditions. A high nutritional status of the basic stock cannot be ensured economically in the country because of acute shortage and the consequent high prices of the requisite inputs like poultry feed ingredients. Consequently, the hybrid chicks produced from those basic stock may not be as adaptive to a poor environment. There is a view among eminent geneticists that greater benefits may be derived if the breeding stock is reared in the environment where their progenies are going to perform. There are distinct possibilities of developing strains more favourably adapted to the ecological niches prevailing in the country. Urgent measures are, therefore, imperative for taking up large-scale poultry breeding programmes for development of such stock. If the programmes are properly pursued, the dependence on foreign sources would soon be

eliminated and would probably lead to the development of a strain suitable for the conditions prevailing in other developing countries as well.

31.4.9 In paragraphs 31.3.10 and 31.3.12 a mention has been made of the poultry breeding programmes initiated by the Central Government on a modest scale for evolving high yielding strain/lines within the country. To widen the germplasm pool, a fresh batch of 10,000 day-old pure line chicks of White Leghorn and Australorps were imported from Australia in December, 1965/January, 1966 under the Freedom From Hunger Campaign (FFHC) of the Food and Agricultural Organisation of the United Nations. The Government of Kerala also imported from the USA a strain of White Leghorn known as the *Forsgate* strain. The same stock was subsequently taken by the Government of Karnataka and a pureline stock known as *Mychix* was developed.

31.4.10 The programme adopted in the three Central and the selected State Government farms aimed at producing various strains of poultry with high egg laying capacity following the accepted methods of selective breeding. Among the imported stock, the *M* line strain of White Leghorn obtained from Australia proved quite satisfactory when multiplied and tested for egg production. The *M* line birds are comparatively smaller in body size, consume less feed and produce larger number of eggs though smaller in size. The extent of popularity that this strain has gained among the poultry breeders can be gauged from the fact that within a short span of 4-5 years, one million chicks of this strain have been distributed.

31.4.11 The breeding programmes undertaken in the Central and State poultry farms, have yielded some promising results. At least five different strains of White Leghorn, two different strains of Australorps and one strain of Rhode Island Red have been identified as being suitable to form the foundation stock for carrying out selective breeding programmes on an extended basis. The suitability of a strain to form the foundation stock was decided on the basis of an egg laying standard of 200—210 for White Leghorn and 180—190 for Australorps and Rhode Island Red.

31.4.12 The initial attempts based on sire family selection programme made by the Central and State farms in the sixties to develop high egg laying strains of chicken brought limited success and yielded some encouraging results. At the same time deficiencies were noticed that needed rectification to achieve the desired objectives. In some instances, there was failure to implement the technical programmes due to various reasons. In others, required facilities were not created in time or developed to the desirable extent. Coordination between the

Central and State farms was not satisfactory. It was found that the breeding programmes needed enlargement in size and uninterrupted pursuit in a sustained manner. Further, a modification of the technical programme was considered necessary to achieve the desired goal of producing high yielding stocks expeditiously. It was realised that proper coordination and strict adherence to a revised technical programme by all the participating units were essential if success was to be attained.

31.4.13 A revised technical programme was, therefore, drawn up in the early seventies for launching a Coordinated Poultry Breeding Project (CPBP) by the Government of India. It was envisaged that three Central and twentyfour selected State poultry farms in sixteen States would participate in the revised programme.

31.4.14 The technical programme of the CPBP is, in short, one based on intrapopulation index selection method, mainly concentrating on part-year egg production from layers of 20 to 37 weeks of age, and egg weight. The index for selection for egg number comprises information on individual performance, sire family and dam family averages with appropriate weightage attached to each. A common guideline for management practices including provision of balanced nutrition for the stock, and record keeping system were prescribed for all the participating farms.

31.4.15 In order to ensure that in the operation of the project the technical programme is properly followed, three poultry geneticists with specialised knowledge and training in quantitative genetics and poultry breeding were appointed in the three Central poultry farms. The responsibilities of technical supervision and check over the participating State farms in their respective regions devolved on these geneticists.

31.4.16 We are informed that in spite of the great care that was taken to formulate a sound technical programme and the hopes that were raised, the progress in the implementation of the CPBP till now has been slow. As mentioned in paragraph 31.4.13, at the time of initiation of the project participation by twentyfour State poultry farms in sixteen States was assumed. However, only three State poultry farms in Maharashtra, two in Rajasthan and one each in the States of Karnataka, Madhya Pradesh and Orissa, i.e., a total of eight State poultry farms have so far been able to undertake the work on the Project in varying degrees. Besides, work has been initiated in Punjab on a limited scale. A modified programme has been taken up in Uttar Pradesh. Even among the three Central poultry farms, some tangible progress has been made only in one farm located at Hessarghatta.

31.4.17 Even though the progress in the implementation of the CPBP has, in general, not been as envisaged in the beginning some of

the results obtained from the work carried out so far, particularly at Hessarghatta, show good promise. The work in the initial stages at that farm enabled identification of a few strains in different breeds that seemed suitable for development. Subsequently, through selective breeding, success was achieved in evolving two White Leghorn and one each of Rhode Island Red and Australorps high egg-producing strains that appeared very promising for producing high quality strain-cross or breed-cross chicks. The success in evolving the strains encouraged the Hessarghatta farm to undertake strain-crossing and breed-crossing work on a pilot basis. This was done in consideration of the fact that production of strain-cross or breed-cross hybrid chicks was the ultimate objective for which the project was launched.

31.4.18 A separate unit for Random Sample Test (RST) of egg laying stock had been established in 1969 by the Central Government at the Hessarghatta farm. With development of this facility, it was considered desirable to determine the egg laying potentiality of the stock evolved under the CPBP. Random Sample Tests were, therefore, carried out with strains of White Leghorn developed at Hessarghatta and other farms under the Project. In addition to these, strain-cross and breed-cross birds evolved at Hessarghatta and birds from other Government and private farms and commercial hatcheries were subjected to such tests. Four such RSTs have so far been completed.

31.4.19 The results of the RSTs (Appendix 31.1) showed that some of the strains or strain-crosses developed under the CPBP had as good as or higher hen-housed production than those from some reputed franchise hatcheries. The problem of adaptability to an alien environment was possibly responsible for the comparatively poorer performance of the stock from the franchise hatcheries. The RST results indicate that the possibilities of achieving the ultimate goal of producing commercial hybrid chicks from strains/lines developed within the country are quite promising. The achievement of the goal, however, would only be possible provided the CPBP is pursued energetically with due attention to details, at a number of poultry farms in an uninterrupted and sustained manner.

31.4.20 The operation of the CPBP over these few years has revealed the possibilities of creditable achievements but it is necessary to take effective steps for removing the constraints that are now standing in the way of proper implementation of the Project on a big enough scale. This is urgent and essential for achieving the objectives for which the programme was launched. It is needless to emphasise the necessity of maintenance of a uniformly high standard of management in all the participating units to reduce to the minimum the variations in the breeding flocks due to environmental differences. Unless this is

ensured it may be virtually impossible to draw valid conclusions from the results obtained.

31.4.21 According to the information available with us, the most serious shortcomings relate to the lack of adequate facilities in several of the participating State farms as also to some extent in the Central poultry breeding farms. Suitable personnel in adequate numbers are also lacking in some of the participating farms. If the required physical facilities and properly trained personnel in adequate numbers cannot be provided in a poultry farm, we feel it would be a complete waste of time and money to incorporate that farm as a participating unit. It has been the experience in the past that in several of the farms where the programme was given a start on the assurance of provision of all necessary inputs, no headway could be made as, for some reason or other, the assurances remained unfulfilled. Technical staff from some of the farms were given inservice training in poultry breeding and genetics at the CTIPP&M, to enable them to properly implement the technical programme. But, several such trained persons on completion of their specialised training were utilised for other purposes than guiding the CPBP. Due to the present administrative set up in the Animal Husbandry Department of most of the States and the prevailing system of rather frequent transfers, a person in-charge of a breeding farm quite often changes his place before achievement of any tangible results from a breeding programme. This happens even for very well-planned projects of immense value and possibilities. To get over this serious, very real and long persisting problem, we recommend that the persons in-charge of important breeding projects should not be transferred during the tenure of the projects. If a promotional opportunity would come about for such persons by way of seniority or otherwise, they should be given pro-forma promotion without a change of place. The inadequacies of physical facilities, shortage of technical staff, non or malutilisation of specially trained staff and administrative difficulties mentioned earlier in the paragraph are adversely affecting the operation of the CPBP in the participating farms of both the Central and State Governments. Remedial measures are called for to set matters right in both the Central and State farms if the CPBP is to attain its objectives.

31.4.22 Considering the limitations of resources and the difficulties that come in the way of the State Governments in providing adequate funding facilities and technical expertise, it would be desirable to make a fresh reappraisal of the CPBP. From the reports that we have received, it appears that to make a success of the Project which is showing promise, it would be necessary to make some basic changes for funding the same. It is also necessary that the areas of work that

may be undertaken by the respective Central farms and the other participating State poultry farms are clearly defined. We are of the opinion that the most satisfactory arrangement would be to remodel the present Project as a Centrally sponsored National Co-ordinated Poultry Breeding Project (NCPBP) so that the expenses relating to the execution of the programme in the participating State poultry farms are borne partly or wholly from the Project. Such an arrangement would overcome most of the difficulties that were encountered in the past in several participating State farms that were unable to develop the required facilities, primarily because of lack of funds. For the three Central poultry breeding farms also there should be a separate budget provision for the operation of the Project adequate to meet the requirements of the work specified for a particular farm.

31.4.23 The Government of India poultry complex at Hessarghatta comprises the Central Poultry Breeding Farm, a Central Hatchery, the RST units and the CTIPP&M and other facilities such as a well-equipped nutrition laboratory, data analytical equipment and a technology laboratory. The housing and the breeding space, however, are inadequate even for multiplication of poultry and proper management of existing breeding programmes. This poultry complex offers a good scope for being developed as the Central unit of the proposed NCPBP to undertake a comprehensive programme of identification and testing of strains that may be collected from within the country and from abroad and also of development of new strains for commercial exploitation. This farm should, therefore, be provided with adequate buildings and funds to perform the function of the Central unit. The other two Central poultry breeding farms at Bombay and Bhubaneswar also need to be strengthened, particularly in respect of housing facilities. Provision of necessary funds for this purpose is urgently needed. As for reallocation of work for execution of the programme of the proposed NCPBP, the farm at Hessarghatta should function as the Central unit. The other two Central farms at Bombay and Bhubaneswar may be utilised for undertaking appropriate selective breeding programme on suitable strains tested and identified at the Hessarghatta centre for developing strains/pureline for production of commercial hybrid chicks.

31.4.24 With regard to the participating State poultry farms, we are of the opinion that instead of spreading out the work of the NCPBP in a number of State farms with inadequate facilities as is the case at present, it would be more profitable to keep the activities concentrated in a limited number of farms where there can be no doubt concerning availability of necessary inputs and services. For the selection of State poultry farms for participation in the proposed

NCPBP for strain development work, a fresh examination and reappraisal of the poultry farms in the country by technical experts will be required as also fresh negotiations with the concerned authorities.

31.4.25 Apart from the State poultry farms selected for strain development work, another group of State poultry farms with suitable facilities could be utilised for large-scale testing and multiplication of the strains developed in the three Central poultry farms and the selected strain-developing State farms. The Central poultry farms should demarcate the participating strain-developing State farms and also the State farms for large-scale testing into three regional groups. Each region should be assigned to a particular Central farm for execution of the breeding and testing programmes. The strains to be developed and the progenies to be tested for production performance should be sent from the Central poultry farms to the State farms in their respective regions. Such a step in testing the strains would help in developing stocks for general adaptability over a wide range of environmental conditions. The Officer-in-charge of the proposed NCPBP at the Central unit at Hessarghatta should, in addition to his own work, act as the Project Co-ordinator. He should be responsible for coordination of work of all the participating units up to the stage of testing the performances of the developed strains. As the Central unit at Hessarghatta has the data processing laboratory, the production records from the State farms should be evaluated there. One or two large State farms can take up the responsibility of maintenance of parent and grand-parent stocks developed by the Central or the strain-developing State farms for production of strain or breed-crosses or incrosses in addition to the work of testing the production performance of developed strains. Other smaller State farms can be utilised for production of commercial hybrid stock for distribution to large and small poultry producers in the respective States. If a number of hatcheries are identified in a State for production of hybrid chicks it is considered advisable that only the males of the male lines, and the females of the female lines are supplied to those centres from the main strain-developing farms in the State. This restricted supply of males of the male lines and the females of the female lines to a particular farm will avoid any mixing and thus prevent deterioration in the quality of the final commercial stock produced for sale and distribution. In these hatcheries for production of hybrid chicks, only mass mating will be undertaken for obtaining hatching eggs and day-old chicks. With the exception of the poultry farms where a breeding programme is followed to evolve and/or to test strains, all other farms in the States

should be run on sound commercial lines to yield reasonable profits. The farms should be so organised as to provide adequate facilities and enough flexibility for the administration to take quick decisions in the matters of implementation of policies, financial problems etc. for efficient management and functioning of the farms under their charge.

ICAR Research Projects

31.4.26 A mention has been made in paragraph 31.3.6 of some ICAR poultry breeding projects that were executed at the IVRI and some State poultry farms as a part of the Grow More Food Campaign. Subsequently in 1965, the ICAR sponsored two research programmes at the IVRI, one for developing high egg-laying strains of White Leghorn, using intra-population selection and the other for development of broiler strains by diallel crossing techniques. These programmes were terminated in 1970. The results of these experiments did indicate the possibilities of development of suitable strains of poultry for high egg and meat production by following appropriate methods of selective breeding. The results, however, were not conclusive and, therefore, did not contribute in any significant measure to the development of strains for commercial exploitation. This venture, however, exposed a few inadequacies that prevented the achievement in full of the expected results. Of the inadequacies noticed, the most important one was the smallness of the size of the population of the birds included in the experiments. Consequently, two large All India Co-ordinated Research Projects (AICRP) with the same objectives as before were redesigned and initiated by the ICAR in 1970. Steps were taken to avoid the inadequacies that were observed during the course of operation of the earlier projects.

31.4.27 The objective of the AICRP for egg production is to develop commercial hybrid chicks involving White Leghorn breed of poultry. The project for egg production is being operated at the IVRI, UP College of Veterinary Science and Animal Husbandry, Mathura, Andhra Pradesh Agricultural University, Hyderabad, and the Jawaharlal Nehru Krishi Viswa Vidyalaya, Jabalpur, with the IVRI serving as the coordinating centre. The broiler project envisages developing commercial hybrid chicks capable of producing broilers of 1.5 kg live weight at ten weeks of age with a feed efficiency of 2.5. For the broiler project also four centres have been established, one each at the IVRI, Orissa University of Agriculture and Technology, Bhubaneswar, Tamil Nadu Veterinary College, Madras, and the University of Agricultural Sciences, Bangalore with the IVRI serving

as the coordinating centre.

31.4.28 Though the projects were initiated in 1970 the implementation of the technical programme was delayed because of the time-lag in recruitment of suitably qualified staff and creation of other facilities by way of poultry houses, equipment and procurement of suitable germplasm etc. Towards the end of 1971 and during 1972, a number of good quality pure strains belonging to one or different breeds were collected both from within the country and from abroad. Fifteen White Leghorn strains for the project for egg production and four Plymouth Rock, five Cornish and two New Hampshire strains (a total of eleven strains) for the broiler project have been procured.

31.4.29 About three years have passed since the technical programmes for the two projects have been implemented. We have been informed that a few strains have been developed under the egg project that lay more than 220 eggs during the test period of 500 days from the date of hatch. Recently, some potentially promising strains have been crossed to find out the performance of single crosses and to determine further procedure to be adopted in the development of strains for commercial exploitation. In the broiler project a few strains have been developed which when crossed produced hybrids that weighed more than 1.5 kg at ten weeks of age with a feed efficiency of 2.5 or better. According to the information available with us, the testing of the birds in the AICRPs either for egg or for broiler production has remained confined so far in the farms participating in the projects. The stock from these projects have not been subjected to the RSTs being conducted by the Central Government at the Hessarghatta RST units. This is not desirable, and we strongly recommend that the strains/purelines developed under the AICRPs for egg or broiler production should be regularly subjected to RSTs along with other stock from the CPBP, other State farms and private hatcheries.

31.4.30 The results achieved in the two AICRPs show promise of evolving strains suitable for production of high quality commercial hybrid chicks both for layers and broiler birds. But it should be noted that though five years have already elapsed since the AICRPs were initiated, not a single egg or broiler strain is ready for release for commercial exploitation. As the objective of both the CPBP of the Central Government and the AICRPs of the ICAR is to attain soon a self-sufficiency in the matter of production of high quality commercial hybrid chicks, this fact cannot be ignored. Considering the urgent need of attaining self-sufficiency in the production of genetically superior breeding stock, the delay in achieving the objective is a matter of much concern.

31.4.31 Among the various developmental activities undertaken for promotion of poultry industry, we attach very great importance to the breeding programmes initiated by the Central Government and the ICAR. The success or failure of these projects would greatly determine the future of the poultry industry in the country. The necessity of freeing the industry of dependence on poultry breeders abroad as early as possible cannot be overemphasised. Scientific poultry breeding programmes for development of strains for production of hybrid chicks were first undertaken at the Central poultry breeding farms and under the projects sponsored by the ICAR about a decade ago. After operation for five years the programmes under both the organisations were found inadequate and modified with change in technical programmes. In the operation of the revised programmes avoidance of the pitfalls and inadequacies observed during the operation of the earlier programmes was emphasised. In spite of all these, the progress in the implementation of the programmes of both the Central Government and the ICAR projects is much slower than what was envisaged at the time the revised programmes were formulated. The AICRPs of the ICAR do not suffer from the difficulty that has been encountered in the CPBP of the Central Government in the availability of funds for developing the required facilities in the participating farms. We are informed that though the objectives of the Central Government and the ICAR projects converge in the matter of development of strains for egg production, these two projects are working almost in isolation. As the objectives of both the projects are egg production much would be gained by coordinated collaborative work between the two projects. We also feel that to achieve early success in the attainment of their objectives, considerably more dynamism and sense of urgency must be brought to bear on the operation of the Central Government and the ICAR projects. We are pleased to know that the Union Ministry of Agriculture and Irrigation have recently constituted a committee of experts for proper coordination of work now under progress in the CPBP and the ICAR projects. At the termination of these projects, such breeding activities should be taken over by the National Avian Research Institute referred to in paragraph 31.10.2 as a part of their normal activities. In our view, there is considerable merit in simultaneous operation of two separate coordinated breeding programmes, one by the Union Ministry of Agriculture and Irrigation in collaboration with State poultry farms and the other by the ICAR. This is because there is no sure-shot breeding technique for achieving the objectives. Simultaneous operation of the programmes would largely safeguard against possible failures. Though simultaneous operation of the two coordinated projects gives greater

promise for achievement of success this can be realised if the projects function in close collaboration in a complementary manner. There are several areas of collaboration. Stocks can be exchanged, experiences can be shared, joint discussions can be had and views exchanged in periodically arranged seminars and work-shops. As the Central Government poultry complex at Hessarghatta has the facilities for RSTs as also data analysis equipment all the performance tests of the developed strains should be conducted there. It would be of advantage to have much of the work of data analysis of both the projects carried out at Hessarghatta.

PL 480 Research Project on Indigenous Fowl Germplasm

31.4.32 Breeding experiments conducted by the IVRI in the forties and fifties, had established that *desi* fowls had potentialities for higher egg production. The investigations on *desi* poultry, however, were not continued mainly because there were no prospects of the research findings being utilised for poultry production at that time. As poultry industry developed subsequently, interest was revived in studies on *desi* fowls and in the mid sixties two large-scale research projects were initiated at the agricultural universities at Hissar and Udaipur* supported with finances from the PL 480 fund to evaluate native fowl germplasm resources and the performance of crosses between the native fowl and the exotic breeds. It is reported that in some of the studies made under these projects, the *desi* or its crosses with exotic breeds were found to be superior to pure exotic stock in respect of production performance, livability, and disease resistance, when those were maintained under a high standard of management.

31.4.33 The indigenous fowl resources have not found any significant place so far in the poultry breeding programmes for the production of hybrid commercial chicks in the country. But it may become necessary in future to incorporate some of the desirable characteristics of *desi* fowl in the commercial breeding stock. Considering the importance of this matter, we recommend that a programme should be initiated by the ICAR to collect and preserve native fowl germplasm resources.

Preservation of Germplasm

31.4.34 Identification and development of strains are a continuous process and there should be unceasing efforts to locate and maintain high producing strains within the country and to import purebred, disease-free strains when suitable ones are available. In the past,

* University of Udaipur was designated as Agricultural University for a short period of time.

several good strains imported from abroad lost their identity due to improper management and negligence in the maintenance of proper records. Preservation and improvement of germplasm are important for supporting a prosperous poultry industry. We, therefore, recommend the creation of Central Germplasm Banks in different agroclimatic regions where large populations of the distinctly identified strains/lines will be maintained under high standard of management to avoid deterioration in their performance. In the previous paragraph the importance of maintenance of the germplasm of indigenous poultry has been indicated. In addition to the maintenance of the purebred superior strains, distinct varieties of indigenous stock may also be preserved at these Central Germplasm Banks in flocks of adequate size for use in research projects.

31.4.35 Efforts should also be made to synthesise new genetic material at regular intervals by pooling the various stocks available in the country for development of random bred control populations. These control populations will form a base material both for carrying out breeding research and for differentiating the genetic trend from the environmental trend and thus serve a dual purpose. We are of the opinion that for proper maintenance and efficient management of the Banks, these should be placed under the control of a high level Standing Committee on Poultry Development, established by the Union Ministry of Agriculture and Irrigation and charged with the responsibility of looking after various poultry development activities in the country. We recommend that the Committee of Experts formed for coordination of work of the CPBP and the ICAR poultry breeding projects may be transformed to the Standing Committee as proposed, with wider representation. For making the change effective, the Committee of Experts should be enlarged to include representatives from the agricultural universities, State Governments and All-India Poultry Industries' Association. Besides having control over the Central Germplasm Banks there are several other functions which we have discussed later and which in our opinion should come under the purview of the Standing Committee on Poultry Development.

Random Sample Test

31.4.36 The technique of Random Sample Test (RST) for evaluating the performance of the poultry stock under uniform feeding and management conditions is an accepted practice in all countries advanced in poultry breeding. Such tests help in obtaining information on the genetic gains and also in providing guidelines to poultry breeders for effecting improvement in their flocks. In India, Random Sample egg

laying test was first started in 1963 at the IVRI but it was discontinued in 1971. A separate unit for RST was, however, established at Hessarghatta, Bangalore in 1969 under the direct administrative and technical control of the Union Ministry of Agriculture and Irrigation. At present, for the egg laying test being carried out at Hessarghatta, a sample size of 45 is being used. Sample size and measures for controlling the environmental variations are directly related to the accuracy of results. In most countries where Random Sample Tests are conducted, the sample size is much larger than the one at present being used in India and tests are also conducted at more than one location. The accuracy of the tests will be increased, if the birds are tested in small groups with the tests being replicated within a test location and between test locations. Testing the same stock at different locations will detect the effects of different agroclimatic conditions of the country on the performance of the birds. This is important for the breeders to decide either in favour of developing a stock of general adaptability or developing various stocks specially suitable for different environmental conditions. It has been reported to us that the Central Government have recently approved the establishment of three more testing units, one each for the Western, Eastern and Northern regions. In our view, one additional unit should be established at a high altitude area as there are special problems of adaptation of farm animals in such areas.

31.4.37 In order to attain greater accuracy in the RSTs, the present test-sample size of 45 pullets should be increased to at least 60 per entry per test centre. The quality of testing and its reliability are matters of crucial importance in achieving the objectives of the RSTs and unless these are assured, it would be waste of money and efforts to establish test centres. These centres must be provided with all the essential physical facilities and should be manned by properly trained staff. To generate confidence among the participants the RSTs should be conducted under the control of the Standing Committee mentioned in paragraph 31.4.35.

31.4.38 At present the RSTs are being carried out at Hessarghatta, primarily on egg production. RSTs for broiler production have only been initiated. Work on tests of broilers may be enlarged at Hessarghatta as the need develops and this facility should also be developed at the other regional RST units as and when those are established. In broiler test, the breeder flock should be put to test besides testing the commercial broiler. Initially a concerted drive is necessary to induce all the private and public sector hatcheries selling eggs and birds to the poultry farmers for breeding purposes to participate in regular RSTs by explaining the advantages that they may derive by doing so.

A stage may be reached when it will be possible to make participation in the tests mandatory.

Certification of Stock

31.4.39 Till the stage of compulsory testing as mentioned in the previous paragraph is reached, some action should be taken to avoid any setback to the progress made in poultry development. We suggest that as a first step, all the hatcheries selling chicken for commercial purposes may be licensed. The hatcheries should also be required to give extensive field trials before any commercial strain is released for general sale. The reliability of performance of the stock claimed by the breeder or a farm and the advisability of releasing a stock developed for commercial use should be decided by the Standing Committee on Poultry Development as mentioned in paragraph 31.4.35.

Chick Sexing

31.4.40 Sexing of day-old chicks is an inseparable part of modern poultry industry and it is essential that adequate expertise is readily available to perform this work. There are two methods of chick-sexing. The feather sexing techniques followed by some commercial breeders is easier and more accurate. This involves incorporation of auto-sexing gene in the stock that permits easy sex identification on the basis of the feather pattern. The other method known as the vent method or the Japanese method of sexing day-old chicks, requires development of a special skill by training. A capable sexer can identify the sex with a very high degree (98 per cent or more) of accuracy. The public sector hatcheries depend at present exclusively on the Japanese method of sexing. The other method is not being contemplated in the breeding programme of these hatcheries.

31.4.41 In spite of a great dearth of competent chick sexers, no arrangement for regular training exists in the country. A training programme on chick sexing by the Japanese method was initiated in 1966 at the IVRI with the help of a Japanese expert and a number of poultry farm workers were trained to attain satisfactory skill. The programme of training, however, did not continue on a regular basis. Subsequently, the training programme was arranged occasionally with the help of the locally trained persons. High efficiency for chick sexing can be maintained only by constant practice. Since the majority of the persons, trained earlier by the Japanese method had considerably lost their efficiency due to lack of practice, the quality of training declined appreciably. We have been informed that in February, 1975, an *ad*

hoc training course was arranged for a short duration at the CTIPP&M with the help of a Japanese expert. There is an urgent need of organising on a regular basis chick-sexing training courses. These should be organised in a poultry breeding farm where there is a constant need of chick-sexing on a mass scale. We recommend that the trained persons should appear in an examination for recertification of their accuracy and speed of work at an interval of every three years. This arrangement together with attractive service conditions would ensure maintenance of a high standard of efficiency by the trained chick-sexers. Preferably, three or four persons in the chick-sexing training farm should be well trained so that the training programme may not suffer in the event of one leaving the job. To ensure a high standard of training programmes it may be desirable to send a few qualified persons for advanced training to the best chick-sexing training institutes abroad. Steps may also be taken for incorporation of autosexing genes in the commercial strains that are being developed in the Government poultry breeding farms and by the ICAR under the poultry breeding projects.

Broiler Production

31.4.42 The demand for broilers is increasing in cities and large towns. As mentioned in paragraph 31.3.9 essential facilities for broiler production were created during the sixties. With a view to providing quick dressing facilities, two large dressing plants have been set up, one at Poona with an installed capacity of handling 8,000 broilers a day and another at Chandigarh with a capacity of 4,800 a day. Besides, 15 small dressing plants, each with a capacity of handling about 1,000 birds a day, have also been produced under the FFHC and supplied to the States for encouraging broiler production. The existing commercial hatcheries are carrying breeding stock imported from abroad for propagating special meat line chicks which are noted for high growth rate and feed conversion efficiency. As mentioned in paragraph 31.4.27, breeding programmes have been taken up at the IVRI and the agricultural universities at Bangalore, Madras and Bhubaneswar for evolving suitable broiler strains. The feed manufacturers are now marketing special broiler mash.

31.4.43 In view of these favourable developments, an intensive broiler production programme should be taken up at least around the poultry dressing plants. There are 17 dressing plants in the country, out of which two are large. Though the supply of broilers for the two large dressing plants at Poona and Chandigarh is not adequate to keep the plants working regularly to capacity, it is at least keeping the plants viable. It has been reported to us that amongst fifteen, 1,000-bird

dressing plants, one each has been installed at IVRI, Izatnagar and CTIPP&M, Hessarghatta. The situation of the 13 dressing plants in or near the IPDP Centres is, however, not at all satisfactory. These plants should now be partially utilised for dressing culled hens. Assuming that two-third of culled hens from a block of 3,000 farmers under SFDA/MFAL will be processed in each of these plants, they can then be utilised for 100 days in a year. For the remaining 200 working days we recommend that the plants should process broilers. To have the required supply of broilers assured, we recommend that around each of these plants a Cooperative Society of 100 members may be organised. Cooperatives should encourage the members through supply of chicks, feed credit and technical know-how, to produce adequate number of broilers so that the full requirement of the plant for a day is available from two farmers. Since each farmer can raise about four crops of broiler in a year, this will make supplies available for the plant for 200 working days in a year. The entire requirement of funds for this programme may be drawn from institutional sources. The State Government should provide the extension staff to help the farmers in maintaining the optimum management conditions of the broiler farms. The broiler operation can also be taken up by the egg producing farmers provided separate housing arrangements are made to avoid the risk of disease hazards. If it is possible to identify some progressive farmers amongst the egg producers who would be willing to take up this venture, 100 such farmers may be picked up per centre.

31.4.44 The egg production farms sell away the hens at the end of the laying period. The specialised large egg producing farms have to dispose of these birds within a very short period of time in order to make the poultry house ready for receiving new flock of birds. In the absence of any processing technique and organised marketing channels, these birds are supplied to the middleman at very low prices. This is also the case with the small egg producers who are away from the dressing plant, and are located in remote rural areas. Even after full utilization of the present facilities of the existing dressing plants as indicated in the previous paragraph, it will not be possible to handle the birds from large farms as well as those from the remote villages. If a cheap and suitable process for cooking and packing these birds could be found, that would be beneficial to the large egg producing farms as also to small farmers in rural areas. We, therefore, recommend that the IVRI and the Central Food Technological Research Institute (CFTRI), Mysore should jointly study the problem.

Poultry Rearing under Different Husbandry Practices

31.4.45 At present, three levels of poultry husbandry practices exist

in the country : (a) specialised commercial enterprises in and around urban, semiurban and industrial belts where high standards of poultry management have been attained ; (b) groups of poultry farms where a level of medium management practices exist with some inputs and knowhow of modern poultry raising ; and (c) backyard poultry keeping practices followed extensively in the rural areas with small poultry flocks predominantly of *desi* birds. In consideration of the experiences gathered so far in poultry farming in the country we suggest adoption of the following policy for propagation of poultry stock under different husbandry practices :

- (i) For the areas where high standards of poultry husbandry exist, high producing straincross or incross hybrid chicks should be made available. To meet the evergrowing demand for these chicks, continuous efforts for necessary developments will be required of both the private and public sector hatcheries for several years to come.
- (ii) For the poultry farms in the intermediate stage of development, crossbred birds would be preferable. The crossbred birds are less affected by adverse environmental conditions as compared with the specialised straincrosses or incross hybrid chicks. According to some poultry experts, medium sized crossbred birds viz., those obtained by crossing White Leghorn males with either Rhode Island Red or Australorps females would be the most suitable ones for such poultry farms.
- (iii) For the rural areas with backyard poultry rearing practices, the most practical breeding programme would be that of grading up the local stock with improved exotic varieties. In taking up such a programme, however, it should be kept in mind that indiscriminate dissemination of exotic genes by distributing males of improved varieties in a totally unimproved environment, is likely to do more harm than good. Attempts at improving *desi* stock by distributing the cockerels of purebred improved varieties like White Leghorn, Rhode Island Red or Australorps did not prove successful in the past. Because of advantage of crossbreds over the purebreds in withstanding adverse environmental conditions, we suggest that improvement of *desi* stock may be accomplished by using crossbred males (crosses between either White Leghorn males and Rhode Island Red females or White Leghorn males and Australorp females). It is further suggested that the crossbred males to be used in grading up the indigenous stock

should be reared under semi-intensive or free range system so that they are not at a disadvantage when distributed in the villages at the age of 20-22 weeks. It is also very necessary that crossbred cockerels are distributed only in exchange of *desi* cocks and utmost care is exercised to replace all the indigenous cocks, and cockerels by crossbred males simultaneously. In such a programme, if all the *desi* males are removed and only the crossbred cockerels are available for breeding, the first generation crosses will have fifty per cent exotic inheritance and fifty per cent indigenous inheritance. The subsequent *inter se* mating after removing all the original *desi* hen will maintain the same proportion of exotic and indigenous inheritance unless any change in the breeding programme is contemplated. It is expected, that following this method of breeding the production level would be doubled in the very first generation of crosses. Good health protection measures are essential for such a programme. The programme of grading up the indigenous stock should first be undertaken in some selected villages to demonstrate the effectiveness of the scheme and once the rural people are convinced of the advantages of such a breeding programme, it would not be difficult to extend it to the other surrounding villages. The greatest advantage of this programme is that the operation of change of cocks need be done only once and subsequently the next generation cocks may be left till such time the necessary inputs are available to warrant further improvement of the stock.

Poultry Estates

31.4.46 In the Union Territory of Delhi, a poultry estate has been set up at Ujhwa-Najafgarh, by a cooperative organisation to provide gainful employment to suitably qualified youngmen. The poultry houses in this estate were constructed by the Cooperative with loans obtained from the Agricultural Refinance and Development Corporation with guarantee from the Government of India. The youngmen settled in this estate were given various kinds of assistance to develop their poultry farm. We have been informed that the poultry estate at Delhi is functioning satisfactorily. In view of this development, we recommend that several poultry estates may be established on similar lines in carefully selected locations in different States and Union Territories. The units in these poultry estates may be allotted to suitably qualified youngmen seeking employment. They will be individually

responsible for the management of the poultry farm established in the allotted unit. We are of the opinion that the Governments of the States and Union Territories should arrange to construct the poultry houses, develop the area and allot the units on lease to selected persons. A cooperative society of the participating members should be organised to look after the servicing of the units and provision of inputs. Such poultry estates besides providing employment to the educated unemployed, may be utilised for rehabilitation of the physically handicapped.

Poultry Farming in Orchards

31.4.47 Many orchards provide an abundant supply of insect life and greens all the year round which poultry can utilise as feed. We are informed that with supplementation by some grains and bran an acre of orchard can easily support 200 layers. Rearing poultry in orchards is at the same time advantageous to the orchards since the birds would keep it considerably free from insects and worms and birds' excreta would increase the fertility of the soil. Rotational foraging, if introduced, would further keep the worm load low in the birds with consequent better performance. For poultry farming in orchards, crossbred birds would be more suitable. Considering the promise of poultry farming in orchards, the agricultural universities in orchard growing States may investigate its economics. The main objective of such studies should be to determine the optimal conditions for poultry rearing in orchards. After this has been ascertained, attempts should be made to popularise this kind of poultry farming through propaganda, demonstration and extension media.

Poultry Production through SFDA/MFAL Projects

31.4.48 The substantial development of poultry industry at present is centred mainly around large cities and towns where a large number of commercial poultry farms have been established. The benefits of the development have gone largely to the comparatively rich urban entrepreneurs. The bulk of the poultry in the country is raised in rural areas by poor peasants and landless agricultural labourers who maintain small flocks of 5 to 10 birds. The main source of supply of eggs and table birds for the markets in towns and cities is, thus, the rural poultry farms. Improvement of poultry farming in the rural areas will not only boost poultry production to a great extent to build a firmer base for the poultry industry, but will have the additional advantage of improving the economic lot of a large number of small and marginal farmers and landless labourers.

It is now the accepted policy of the Central Government that in livestock development work, the major share of the benefit should go to the rural sector to increase income and employment opportunities of the small and marginal farmers and landless labourers.

31.4.49 In our Interim Report on Poultry, Sheep and Pig Production through Small and Marginal Farmers and Agricultural Labourers for Supplementing their Income (hereinafter referred to as the Interim Report on Poultry, Sheep and Pig Production), we have indicated in details the approach for poultry development through these classes of farmers. The developmental programmes recommended by us are comprehensive and give details of the type of stock to be supplied, the size of the poultry units, systems of rearing to be followed, poultry housing, feed supply, health cover, training of the poultry farmers, financial assistance and organisation of cooperatives. In this Interim Report we have recommended that in the SFDA/MFAL projects poultry production should be promoted in 167 districts and in each district about 3,000 beneficiaries should be identified and enrolled for participation in the programme. It has come to our knowledge that the Union Ministry of Agriculture and Irrigation has proposed implementation of the programme in only 60 districts during the Fifth Plan period due to financial and other constraints. We hope that with the experience gained during this period and with improvement in the financial outlook it would be possible for the Central and the State Governments to accelerate the pace of the programmes under these projects during the subsequent plan periods. Considering the importance of the projects, we recommend that every effort should be made to implement the programme in all the 167 districts identified by us at least by 1985, if not earlier. As the requirements of eggs and poultry meat will be progressively on the increase, we further recommend, that after 1985, poultry production through these classes of rural people should further be extended. For this purpose, the enrolment in each district may be increased to 5,000 beneficiaries and by the turn of the century, 200 districts may be incorporated for the operation of these projects. If this target is achieved, about one million families of small farmers, marginal farmers and agricultural labourers will be benefited by the poultry production programme in the projects.

5 POULTRY FEEDS

31.5.1 Availability of feeds at economic price is by far the most important pre-requisite for profitable poultry production. Cost of

feeding alone accounts for nearly 70—75 per cent of the total expenditure incurred in poultry farming. An increase in the cost of feeds without corresponding increase in the price of eggs and poultry meat adversely affects the profitability of poultry farm operation. Balanced feed is essential under intensive management system as the birds so reared are unable to supplement their requirement of protein, vitamins and minerals from extraneous sources. Thus, the future growth of poultry industry largely depends on the availability of balanced feeds at reasonable prices.

Shortages and High Cost of Feed Ingredients

31.5.2 Poultry industry is facing a serious crisis at present due to shortages and consequential high rise in prices of various feed ingredients. It has been reported to us that the prices of compounded poultry feeds in some instances have almost doubled during the last three years. A layer consumes on an average about 45 kg of feed during a year of laying. In 1972 with the prevailing price of feed (around Rs. 620/- per tonne in March 1972), the expenditure per bird on feed was about Rs. 28/- per year. The farmer was then supposed to make an annual profit of Rs. 12/- per bird under optimum feeding and management conditions. The feeding cost now is about Rs. 48/- per bird during a year (feed price being Rs. 1200/- per tonne). This has virtually wiped out the profit in commercial poultry farming.

31.5.3 The profitability of poultry farming for egg production is determined by egg/feed price ratio. It is generally accepted that a poultry farmer can earn good profit if he is able to buy one kg poultry feed from the sale proceeds of two eggs. It approaches the break-even point if three eggs are required to buy the same quantity of poultry feed. Thus, to make poultry farming remunerative, either the present rise in feed prices has to be arrested or there should be a corresponding increase in prices of eggs and poultry meat. An abnormal increase in the price of egg and meat will, however, not be conducive to the growth of poultry industry, as this will render these commodities beyond the reach of the majority of middle/lower income group of consumers. Reduced market intake will be the result. A solution, therefore, lies in taking necessary steps to reduce feed cost. In this context, it is necessary to make estimates of feed requirements.

Feed Requirements

31.5.4 Laying stock : We have been informed that 164.6 thousand

tonnes of ready-to-use balanced poultry feed was manufactured in 1974 by the members of Compounded Livestock Feed Manufacturers' Association (CLFMA). In the absence of any reliable data, either in terms of total balanced feed used for poultry or the number of birds, it is difficult to give any objective picture of present requirement of feed. It, however, will not be unrealistic to presume that almost the same quantities of feed as are manufactured by the members of the CLFMA are being manufactured also by others who are not members of the Association. Thus, approximately a total of 330 thousand tonnes balanced mixed poultry feed are being manufactured at present. Corresponding to the demand projection of eggs (high assumption) referred to in paragraph 31.3.15, the number of grown up birds of both sexes (including ducks) is expected to be 215.45 and 299.00 million in 1985 and 2000 AD respectively. The likely breakdown of the different types of layers in 1985 and 2000 AD, therefore, is as follows :

Types of poultry	(in million)	
	1985	2000
Improved fowl	77.5	136.4
<i>Desi</i> fowl	35.0	35.0
Ducks	5.0	8.0

In projecting the above figures it has been assumed that the average production potential of improved layers will be 170 eggs per year per bird and that of *desi* fowls and ducks will be 60 and 100 respectively in 1985. The corresponding figures in 2000 AD are assumed to be 180, 70 and 110. The number of layers and growers in improved varieties are generally in the ratio of 2 : 1. As the number of improved layers would be 77.5 million in 1985 the number of improved growers will then be 38.75 million. It is generally accepted that the feed requirement of three growers is approximately equivalent to that of one layer, and one million layers will require in a year on an average, 45,000 tonnes of balanced poultry feed. On this basis, 4.05 million tonnes balanced feed will be required in 1985 by the improved varieties of egg laying stock (for 77 million layers + 13 million layers equivalent of 39 million growers = total 90 million layers.) The *desi* fowls and ducks meet most of their requirements by foraging. With improvement in the quality of the stock, these birds will require some amount of balanced feed. It is assumed that their requirement will be one-third of that of the improved varieties. Based on this assumption, the requirement of balanced mixed feed of *desi* fowls and ducks (1/3 of 40 million : 35 million *desi* fowls + 5 million

ducks + 7 million growers) is estimated as 0.71 million tonnes in 1985. The total anticipated requirement is, therefore, 4.76 million tonnes (4.05 million tonnes for improved variety + 0.71 tonnes for *desi* fowls and ducks) for the egg laying poultry in the year 1985. Assuming similar norms, the corresponding figure for 2000 AD will be 7.90 million tonnes.

31.5.5 Broilers : Broiler ration constitutes a larger percentage of grain and, therefore, it is more dependent on crop production. It has been reported that 4 million broiler chicks were sold by various commercial hatcheries during 1973-74. There is a steady increase in broiler production in the country. According to a postulation by the poultry experts in the Union Ministry of Agriculture and Irrigation there has been a 50 per cent growth of broiler production in the year 1974-75 over that of the previous year. There is a view among some of the experts that a minimum annual growth rate of 10 per cent will be maintained thereafter, provided conditions regarding availability of feed ingredients remain favourable. Assuming a steady growth of 10 per cent from 1975 onwards, the number of broilers expected to be produced are 17.2 and 71.80 million in 1985 and 2000 AD, respectively. A broiler consumes on an average 3.5 kg of feed during a period of 10 weeks. The balanced mixed feed requirement for broilers, therefore, will be 0.06 and 0.25 million tonnes in 1985 and 2000 AD respectively.

Total Feed Requirement

31.5.6 Thus, the total balanced feed requirement for the entire poultry stock including ducks and the grain requirement (assuming the egg laying and the broiler mashers respectively will have 40 and 50 per cent grain) will be as follows :

Type of feed	(million tonnes)	
	Year	
	1985	2000
Balanced mixed feed	4.71	8.06
Grain	1.90	3.25

If the estimated production of grain in the year 2000 AD, as indicated in Chapter 11 on Supply Possibilities, is achieved in full, there should not be any shortage of grains for poultry feeding. Such a situation will also have an effect on the grain price, thereby creating a favourable egg/meat : feed cost ratio. Till such time, various steps should be taken to procure ingredients at reasonable price and attempts

should be made for increased use of agro-industrial byproducts. At the same time, it would be worthwhile to undertake research studies to develop poultry stock with high feed efficiency, so that the feed cost is lowered.

Feed Ingredients

31.5.7 Feed ingredients like maize, rice polish, wheat bran, molasses, groundnut oil cake are common for compounding ration of several species of livestock and as such, they have been discussed in detail in Chapter 34 on Livestock Feeding. Only a few food ingredients that are of particular importance in the preparation of poultry feeds are considered here.

31.5.8 Fish meal is a good source of high quality animal protein for poultry feeding. There are a number of fish meal plants in the country. When the demand was not very high in the past, fish meal was available at reasonably low cost as a livestock feed ingredient. But with the growth of livestock, especially poultry, the demand for fish meal has continued to increase rapidly and it is becoming increasingly difficult to obtain the product at reasonable price. In recent years, the cost of fish meal has gone up from Rs. 600 to Rs. 2,000 or more per tonne. It is reported that production of fish meal is going down and the meal plants are not being utilised to their full capacity. This is because, owing to improved technology in production, processing and transport, more and more fish and fish products are going to the markets. Hence, less and less inedible fish and fish products are being diverted for fish meal production. As a remedy against this shortage, alternative sources of other marine products which are either inedible or for which there is no demand for human consumption should be explored for feeding the fish meal plants. One such product which may be tried is the mussel. Possibilities of finding suitable alternative sources of marine products as livestock feeds have been dealt with in greater detail in Chapters 34 and 39 on Livestock Feeding and Crustacean Fisheries and their Utilisation, respectively.

31.5.9 Though fish meal is an excellent source of animal protein for poultry, there are other good sources from which the requirement could largely be met. In a number of countries with flourishing poultry farming, because of high cost of fish meal, meat or blood meal constitutes the principal source of animal protein in poultry feeds. Sterilised meat and blood meal from carcass utilisation centres and slaughter houses and silk worm pupae meal can replace fish meal to a great extent. Experiments carried out in a few carcass utilisation plants and

slaughter houses in the country show that good quality meat meal and blood meal suitable for livestock feeding could be manufactured in large quantities at reasonably low cost. The advantages that can be derived from the establishment of plants for large-scale manufacture of meat, blood and bone meals by utilisation of carcasses of fallen and slaughtered animals have apparently not been fully appreciated, either by the State Governments or the private industry. Not much interest has, therefore, been exhibited from any quarter for establishment of big-size carcass utilisation plants. If properly organised and managed such a plant should be a profitable investment. In Chapter 36 on Meat Production and Animal Byproducts, this subject has been discussed in greater details.

31.5.10 In paragraph 31.5.6 we have indicated the necessity of utilisation of agro-industrial byproducts to a greater extent in view of shortages of feed ingredients and in consideration of economy. According to the report published by the ICAR,¹ byproducts like maize gluten meal, tapioca chips, silk worm pupae meal, sal seed cake, fruit wastes, mango seed kernel, pencillin mycellum residue, slaughter house and distillery wastes, and cheaper grains like *ragi*, *cholam*, *kodam* and *sawan* have been found suitable for use in the poultry feeds to reduce the cost of production. In a recent investigation carried out at the IVRI on recycling of poultry droppings, it was observed that dried and autoclaved poultry manure could be profitably utilised in the formulation of poultry feeds. Most of these products, however, are not being incorporated in poultry feeds at present in any appreciable quantities. Extensive feeding trials with the use of these ingredients in poultry feeds in various proportions should be undertaken to determine the optimal ratio and the possibility of field use of these products. Studies should also be conducted on the economics of utilisation of these materials as constituents of poultry feeds. In case the results of these studies indicate the suitability of a few or several of these products as constituents of poultry feeds, it would be necessary to undertake extensive demonstration trials to popularise their use. Inclusion of such materials in areas of easy availability in bulk will appreciably reduce the cost of poultry feeds.

31.5.11 In the regions where lucerne (*Medicago sativa*) and berseem (*Trifolium alexandrinum*) are grown extensively, the inclusion of meals from these fodders in the preparation of poultry feeds will improve their quality and appreciably reduce the feed cost. In the regions that have long hours of bright sunshine, the simplest and the cheapest method is to sun-cure the leaves and stalk for preparing the

¹ Indian Council of Agricultural Research, New Delhi. 1967. *Report of the Study Group for exploring the possibilities of using food byproducts as a poultry feed.*

meal. In other regions it would be worthwhile to set up a few dehydration plants in selected places to make pilot studies on the manufacture of lucerne and berseem meals and their economics.

31.5.12 Studies on poultry nutrition carried out so far in India are inadequate. Recommendations on the nutrient requirements of various classes of poultry and compounding of poultry feeds are, therefore, in many instances based on the work done in foreign countries. Immediate attention should be given to enlarge the scope of research studies on nutrition of different classes of poultry reared under different agro-climatic and ecological conditions prevailing in the country. Emphasis should be on studies on feeding with ingredients easily available locally and economically. The work on least-cost formulation of balanced poultry ration should be taken up on an extensive scale.

Quality Control of Feeds

31.5.13 At present there is no quality control of livestock and poultry feeds. In its absence buyers have no means to assess the worth of a feed and the possible results they can expect. They are totally dependent on the claims of the manufacturers and as such, there is room for unscrupulous traders to exploit the customers. Since this is a problem that is being encountered not only by poultry farmers but all livestock owners using manufactured feeds this has been dealt in detail in Chapter 34 on Livestock Feeding.

6 POULTRY EQUIPMENT

31.6.1 During the last few years satisfactory progress has been made in the country in the matter of manufacture of various kinds of poultry equipment. A wide range of essential equipment like brooders, feeders, cage units, incubators, feed grinders, mixers and various components of grading and processing items are now being manufactured in the country. Not only self-sufficiency in respect of these items has been achieved but the quality and competitive price of Indian poultry equipment have enabled the manufacturers to enter the export market. Foreign aid agencies such as the FAO and the UNICEF in fulfilling their commitments in India are now obtaining the required equipment importing from within the country. These agencies are also supplying Indian equipment to some of the South East Asian countries as Indian manufactured items have been found

to be competitive in price, quality and special specifications with those fabricated by American, Australian and European manufacturers. The poultry equipment manufacturers are facing serious difficulties in procuring the required quantity of iron sheets, iron wires, angle iron, aluminium sheets, and other raw material of the right quality at control prices. This results in a price rise of poultry equipment and that in turn affects adversely both home consumption and export. We recommend that to get over this difficulty, raw materials of standard quality that are in short supply should be made available on a priority basis to the manufacturers of poultry equipment at control prices on recommendations of the Centre/State Animal Husbandry Departments.

7 HEALTH COVER

31.7.1 The need to organise an efficient poultry health programme matching the growth of the industry is urgent and important. It is now necessary for the Animal Husbandry Departments to create a cadre of veterinarians specially trained in poultry diseases to provide effective health cover to the poultry farms in their respective States. It is needless to say that biological products and medicines necessary for providing health cover should be readily available wherever and whenever necessary. Important poultry diseases have been discussed in Chapter 35 on Animal Health and as such are not being discussed here except in relation to some special poultry health problems.

Licensing of Hatcheries

31.7.2 At present no effective means are in existence for the supervision and control of hatcheries, either in the private or in the public sector. As these hatcheries supply eggs and chicks all over the country it is necessary to have a control over the hatcheries to guard against spread of infectious diseases. Besides the diseases that may be spread through chicks, there are some egg-borne avian diseases. Hence, control and supervision over both hatching eggs and chicks are necessary. Incidence of virulent infectious diseases in a hatchery and its spread to other areas from there may spell disaster to the growing poultry industry. In paragraph 31.4.39 we have recommended licensing of hatcheries selling commercial chicks to ensure maintenance of high quality of the stock. The licensing of hatcheries is equally, if not more important in consideration of disease hazards. We recommend that early action should be taken to introduce licensing of

commercial hatcheries under suitable legislation. With a view to ensuring implementation of the programme of licensing on a uniform all-India basis, the licences should be granted only by the Central Government on recommendation of the Standing Committee on Poultry Development (of paragraph 31.4.35).

31.7.3 Disease control : Marek's disease has been posing a serious problem for poultry industry in India since 1969. Vaccine against the disease, not being manufactured in the country at present, is required to be imported from abroad involving expenditure of a sizeable amount in foreign exchange. This special disease problem of poultry has been discussed in greater detail in Chapter 35 on Animal Health. In the same chapter we have recommended establishment of mobile disease diagnostic laboratories in adequate numbers. All such laboratories should be well equipped for diagnosis of poultry diseases as well and have on the staff a competent poultry disease specialist. In paragraph 31.7.1 we have indicated the necessity of creating a cadre of veterinarians with special training in poultry diseases. For this purpose organisation of special inservice training courses in agricultural universities during the summer vacation would be of great help. We have been informed that several commercial poultry producers are at present prepared to pay for effective veterinary service. This is an encouraging development as this will open avenues for private practice in the veterinary field and create employment opportunities for competent veterinary graduates.

8 CREDIT, COOPERATIVES AND MARKETING

Credit

31.8.1 Easy flow of credit to poultry farmers, cooperatives and other organisations is essential for the sustenance and growth of poultry industry. The development of poultry industry as we find today is in no small measure due to the credit facilities that were extended to the industry. In recent years, the facilities for obtaining financial credit for large as well as small poultry projects have increased considerably. A number of commercial banks are now providing loans to meet up to 80 per cent of capital investment and working capital requirements for production of eggs and broilers and for setting up hatcheries to raise day-old chicks. The Credit Guarantee Corporation set up by the Central Government protects the interest of the banks by guaranteeing to meet up to 75 per cent of the defaulted amount or Rs. 22,500 whichever is less in case of a single borrower.

31.8.2 Besides commercial banks, Agriculture Refinance and Development Corporation (ARDC), and the Agricultural Finance Corporation are further extending the credit facilities. The ARDC is currently assisting 12 poultry development projects in Andhra Pradesh, Kerala, Delhi, Maharashtra, Karnataka and Tamil Nadu with credit facilities extended through cooperative societies and commercial banks involving a total outlay of about one crore of rupees. Some more proposals are being processed. Cooperative Credit Societies with the help of State Departments and cooperative and commercial banks are also advancing loans for poultry development.

31.8.3 The institutional credit advanced by banks or corporations to cooperative societies and by other organisations and private individuals has been availed of almost exclusively by the relatively affluent individuals or groups of farmers but not by the poor ones. The promotion of poultry farming through the SFDA/MFAL projects was encouraged by providing subsidy (25 per cent for small farmers and 33-1/3 per cent for marginal farmers and landless agricultural labourers) and loans for purchase of birds and equipment. The procedure for obtaining loans by small and marginal farmers and landless agricultural labourers is still beset with problems. As a basic principle of banking, loans may be advanced only against adequate security and many small farmers find it difficult to fulfil this requirement. A relaxation in rules for granting loans by banks to agriculturists was made by the Reserve Bank of India (RBI) according to which loans up to Rs. 1,500 could be granted to agricultural members of cooperative societies on personal surety; the ceiling was subsequently raised to Rs. 2,000. These steps have removed the difficulties of small and marginal farmers to some extent but not wholly. The difficulty of the landless labourers in securing loans still exists. The stipulation of the requirement of farmer's membership of a Cooperative Credit Society prior to seeking a loan on personal surety cannot be acted upon in areas where cooperatives do not exist. Furthermore, landless labourers cannot avail of these facilities as they cannot obtain membership of farmers cooperatives. We understand that the Act under which the RBI authorised granting loans to small and marginal farmers on personal surety is being amended suitably enabling landless labourers to obtain loans on personal surety. While it is desirable that action should be taken to expedite loans to landless labourers and small and marginal farmers on personal surety, it must be ensured that the loans are given only to bonafide farmers and landless labourers.

31.8.4 In our Interim Report on Poultry, Sheep and Pig Production, we have recommended the extension of scope of poultry developmental work under the SFDA/MFAL projects and for linking up

SFDA/MFAL poultry programmes with the IPDP projects with a view to getting over the difficulty of marketing the produce.

Cooperatives

31.8.5 Most of the poultry farmers in India are in rural areas away from the main marketing centres. It is beyond the resources of individual farmers to arrange for various kinds of services such as supply of birds and feeds, health cover, credit and marketing of products on their own in an effective and efficient manner. The required services can be ensured only through creation of sound cooperative organisations. Vertical integration of various developmental activities concerned with poultry farming in rural and urban areas through cooperative organisation is essential to safeguard the interests of all classes of poultry farmers. The safeguard is specially required in the face of high rise of prices of poultry feed and various other problems that may develop from time to time. The IPDP programmes were based on this consideration.

31.8.6 In our Interim Report on Poultry, Sheep and Pig Production, we have mentioned the recommendation of the Working Group on Animal Husbandry and Dairy set up by the Ministry of Agriculture and Irrigation to form separate poultry farmers' cooperatives wherever these could be organised on an economically viable basis. We have recommended in this Interim Report, establishment of a multitiered structure of cooperatives to assist the poultry farmers. In consideration of the recommendation of the Working Group, a two-tier organisation of small and marginal farmers and agricultural labourers in the poultry production programme of the SFDA/MFAL projects has been recommended. At the rural base level, Poultry Producers' Cooperatives should be established for each block/tehsil. These Producers' Cooperatives will federate into District Cooperatives. The functions of Producers' Cooperatives should be two-fold, one to provide necessary inputs to farmers, viz., credit, supply of birds, feeds, medicines, housing material, equipment, provision of technical guidance, and the other to collect and market eggs and table birds. We have further recommended that for securing short and medium term loans for their members, the primary Poultry Producers' Cooperatives should have a close liaison with tehsil Farmers' Service Society. It would be the responsibility of the Poultry Cooperative Societies to repay the loan taken from the Farmers' Service Society for extension of credit to their own members. This can be arranged by the Poultry Cooperative Societies by recovery of the amount from their members from the price of eggs and birds marketed by them through the Society. Dairy organisations have already developed transport and cold storage facilities in several

districts. We have recommended in the Interim Report that the Poultry Cooperative Societies should avail these facilities as far as possible as this would help in considerably cutting down the overhead cost. The charges to be met by the Poultry Societies for utilisation of transport and spare cold storage facilities of dairy organisations could be settled by mutual agreement. To safeguard the interests of genuine small and marginal farmers and agricultural labourers, the membership of Producers' Cooperatives should mainly be confined to these classes of farmers. Membership could be extended to large farmers with the restriction that the strength of flocks owned by them does not exceed one-third of that owned by the rest of the members of the society. It has also to be ensured that in the Managing Committee of these societies, the small poultry farmers always retain a comfortable majority of two-thirds or more. As an obligation to the cooperative society the members will be required to market all their eggs and birds only through the society. It would be of advantage to the Poultry Producers' Cooperatives at block/tehsil levels to federate into a District Cooperative Union.

31.8.7 The function of the District Cooperative Unions will be organisation of marketing facilities of poultry products obtained from the members. The District Union should assist the federating societies in procuring necessary feed ingredients in bulk at economic price and in the manufacture and distribution of ready-to-use balanced poultry feeds. The manufacture of poultry feeds by the District Cooperatives may be arranged in association with the District Cooperatives of Milk Producers, Sheep Farmers and Pig Producers as that would considerably reduce the cost of manufacture of feeds. Whenever possible, efforts should be made to establish feed plants to be jointly owned by the District Cooperative Unions of Societies of different livestock producers.

31.8.8 The District Unions of poultry producers should enrol themselves as members of the State Cooperative Egg Marketing Federation when it comes into existence during the Fifth Plan period as proposed by the Central Government. The functions of State Cooperatives will be the marketing of surplus egg and poultry products in outside markets and to arrange various other sale promotional activities. These State Cooperatives should federate into regional cooperatives which should eventually combine to form a National Federation.

31.8.9 The Producers' Cooperative Societies require adequate finances to perform at different levels the various functions indicated earlier. As the members of these cooperative societies comprise mostly small poultry producers with slender resources, the financial position of the societies is not strong. These cooperatives are, therefore, not in a position to raise adequate resources to perform efficiently the multifarious

functions that are required for satisfactory development of poultry production by the weaker section of the society. These cooperatives should be given all assistance in raising sufficient funds through various sources. Poultry Producers' Cooperatives need a special consideration from the Government in view of their composition. We recommend that the Government may give financial assistance to increase the share capital of these societies to meet the cost of capital investment and additionally provide sufficient funds to the societies to meet the running cost. This financial assistance from the Government could partly be in the form of subsidy and partly in the form of loans. Managerial subsidy may be given to each cooperative society on a sliding scale as 100 per cent in the first year, 75 per cent in the second year, 50 per cent in the third year and 25 per cent in the fourth year and so on, finally tapering off to the point of no subsidy at an appropriate stage. Institutional credits to the societies may be arranged through the ARC, Central Cooperative Banks etc. in the form of long term loans for capital expenditure and on medium or short term loans for working capital. Where proper leadership is not available to run the affairs of the society as per technical requirements, the State Animal Husbandry Department may make the services of a poultry officer available to the society on loan for carrying out the activities properly, according to the cooperative rules.

Marketing

31.8.10 Poultry development programmes in the country have so far been mostly production oriented with very little attention to marketing organisation. There is no organised national egg and poultry marketing channel in India at present. Though there are a few marketing organisations at the State level, they are limited in size and suffer from operational deficiencies. Major proportion of eggs and poultry products reach the consumer from the point of production through a group of profiteering middlemen but with practically no processing of the products. As a result, both the producer and the consumer lose a great deal, whereas middlemen extract the lion's share of profit without undertaking any great risks. To ensure remunerative return to poultry producers and for supplying good quality eggs and poultry products to the consumers at reasonable prices, formal organised co-operative marketing channels at national, regional and State levels are required.

31.8.11 There are a number of problems of marketing of eggs and poultry products, peculiar to India. Of the existing poultry farms, the percentage of small farms is very high. Consequently, the number of eggs that can be delivered by an individual farmer is small. Any

programme to collect eggs from the farmers' doors is, therefore, bound to be costly. The production areas, instead of being concentrated around consumption centres, are widely distributed throughout the country with many regions not having developed communication and transport facilities. Thus, the production centres are, in general, far away from consumption points necessitating long transportation of the produce and consequent higher cost in movement. Eggs are also exposed to greatly changing atmospheric conditions because of long-distance transportation. Transportation in uninsulated and unrefrigerated vehicles causes deterioration in the quality of eggs. Another peculiar problem concerned with marketing is the widely varying seasonal consumption trends, viz., low consumption in summer and high consumption in winter causing wide fluctuation in market prices. Inadequacy or absence of cold storage facility for eggs during summer considerably increases risks of the wholesalers. This brings about a significant difference in the wholesale and retail prices of eggs. There is no programme of consumer education, advertising and other sale promotion activities, for eggs and poultry products. These activities in our opinion, should be taken up as an integral part of organised marketing programme. For storing eggs during the period of large difference between production and demand, cold storage facilities and proper packaging arrangements need to be arranged by the cooperatives established at the State level as mentioned in paragraph 31.8.8. Another major problem in marketing is the supply of unclean and fertile eggs. Low purchasing power of a large percentage of the Indian population creates a problem for egg marketing as this necessitates pooling of almost the entire produce only to a few high consumption centres. Non-availability of statistical data on volume of production, distribution and receipts, costing and pricing of products pose a serious problem in organizing an effective marketing system. At present there exists no market intelligence and surveillance services insofar as eggs and other poultry products are concerned. We recommend that market survey studies for collection of information on the factors that influence the pricing of eggs and other poultry products should be taken up at regular intervals. Researches on processing and marketing of eggs and other poultry products are very inadequate. Extensive research on the processing and packaging of poultry products keeping in view the socio-economic condition of the country should be taken up immediately for promotion of poultry industry.

31.8.12 Organised efforts to develop a poultry marketing programme were made for the first time during the Third Plan period when the IPDPs were launched. In the IPDP project, the marketing programme was conceived in a manner that would safeguard the interest of the farmers by establishing a close linkage

between feed supply and egg marketing. Unfortunately, this important aspect of the project was grossly neglected. Either marketing programme was not taken up at all or taken up half-heartedly.

31.8.13 While discussing credit and marketing in the Interim Report on Poultry, Sheep and Pig Production, we have given the guideline for establishment of 'Poultry Producers' Cooperatives at tehsils/blocks and at district levels, that will have promotion of marketing as one of their major functions. In the operation of the IPDP projects it has been observed that wherever marketing was taken up in right earnest, the growth rate of poultry farming was definitely higher than in areas where marketing was not given due importance. In several of the projects where marketing was given due consideration necessity arose to exploit the markets in other towns and cities within the State for disposal of surplus eggs. To meet this situation, State level marketing organisations for eggs and poultry have come into existence in some of the States. Some of these organisations are doing well, whereas some others are not functioning satisfactorily. The type of organisation varies, some are State institutions, some cooperatives and others are autonomous corporations.

31.8.14 With substantial increase in poultry production at a rapid rate, the necessity of establishing suitable marketing agencies at the national, State and regional levels was keenly felt by all those concerned with poultry development. With a view to removing the marketing bottlenecks coming in the way of poultry development programmes, the Central Poultry Development Advisory Council, constituted a Committee of experts to formulate a scheme for promoting marketing organisation for poultry. The scheme prepared by the expert committee envisaged the establishment of four Regional Cooperative Marketing Federations at Bombay, Calcutta, Delhi and Madras with a coordinating national body at the Centre. We have been informed that the Central Government have accepted the above recommendations of the expert committee.

31.8.15 The National Egg & Poultry Products Marketing Federation should be fully equipped in all the four regional centres with necessary infrastructure for quick disposal of eggs. If necessary, the regional centres should hire facilities for cold storage to hold surplus eggs during the summer months to ensure economic price to the producers. This organisation should also undertake promotional activities and launch a programme on consumer education. A concerted drive may be made to dispel the widely prevailing mistaken belief that consumption of eggs during the summer months is injurious to health. The Federation may also enter into agreements with milk drying plants to manufacture egg powder as the milk plants are generally idle or operate partially during

off seasons because of inadequate milk supply. We are informed that an egg powder manufacturing plant of $\frac{1}{2}$ tonne per shift capacity has recently been established in Bombay as a private enterprise. The eggs found surplus by the Poultry Producers' Cooperatives in rural towns should be accepted by the State Egg Marketing Federation for selling in the main towns and cities. The unsold eggs should be sent by State Federation to the Regional Centres. The State Federations will require cold storage facilities to hold the eggs in proper storage conditions. They should also have small mechanical egg churners with deep freeze cabinets for breaking the smaller and older eggs with a view to freezing their contents for supply to local bakeries at a relatively low price. It should be possible to run a programme of egg disposal on commercial lines.

31.8.16 Success in the marketing programme will largely depend on the cooperation of the farmers in producing clean and infertile eggs. Unhygienic handling of eggs at the farm before delivering them to the collection counter affects their quality. To educate the farmers in this matter, the State Animal Husbandry Departments may launch a massive drive by way of preparation of extension literature and films in regional languages. The cooperatives may also utilise these materials for educating the farmers. They may also arrange educational lectures or demonstration classes by competent persons and film shows from time to time for the benefit of the members.

31.8.17 We have been informed that the National Cooperative Development Corporation has decided to set up the National Egg & Poultry Products Marketing Federation. To make a beginning in the establishment of the National Federation only one centre will be established in Delhi. After experience has been gained in the operation of this centre steps will be taken to establish the other three centres at Bombay, Calcutta and Madras. Before the programme is initiated at Delhi, a marketing survey is to be conducted to get the clearance of the Planning Commission. In consideration of the great importance and urgency in developing an efficient marketing organisation, we strongly recommend that preliminary work relating to establishment of the National Egg & Poultry Products' Marketing Federation should be completed expeditiously. We also recommend the early setting up of State Marketing Federations where these do not exist.

31.8.18 To overcome the problems of marketing eggs during the summer season, it would be of advantage to modify the production pattern in the rural areas from 12 months production during the year to that of 7 months (Sept.—March), as pointed by us in our Interim Report on Poultry, Sheep and Pig Production. The remaining five months could be utilised for raising the replacement stock. This may,

in some instances, create a problem for the farmers who mainly depend on poultry farming for their livelihood as there will be no cash return for five months. To meet such an eventuality, we suggest that as an alternative arrangement the layer strength should be suitably reduced both in the urban and rural areas instead of total disposal of the stock in rural areas during summer months. The reduction in production is advocated because of low consumption during summer months and the present poor cold storage facilities for holding the eggs. However, it is definitely advantageous for the poultry farmers to maintain a steady production pattern throughout the year provided remunerative prices are received by them. As and when the two constraints, viz., lack of proper knowledge amongst consumers and poor cold storage facilities are removed, the farmers may adopt the technique of more or less uniform rates of production of eggs throughout the year.

9 DUCK REARING

31.9.1 Next to fowls, ducks are the most important egg producing birds in India. In contrast to the ubiquity of keeping of fowls in India, the rearing of ducks is limited to watershed regions. Duck raising is very popular among the villagers of these regions as a profitable backyard enterprise, because the average egg production from ducks is higher than that from *desi* fowls. Even indigenous ducks lay about 90—100 eggs per year as against 50—55 eggs laid by *desi* hens. Moreover, eggs from ducks are obtained with practically no cost to the owners. Ducks have great foraging capacity and need little or no supplementary feeding. Some of the exotic high producing varieties of ducks with scientific management and feeding lay as many as 300 or more eggs annually.

31.9.2 Ducks maintain their egg productivity almost at the same level up to the age of two to three years, whereas, in case of fowls, commercial layers are retained only for a year or a year and a half. Duck eggs are bigger than hen eggs. Because of thicker and stronger shell, transportation of duck eggs is easier and breakage during transit is lesser. Nutritive value of duck and hen eggs is almost the same except for fat content and energy value which are higher in duck eggs than in hen eggs. Duck eggs are acceptable to certain sectors of Indian people who do not take hen eggs due to religious prejudices. However, some do not like the characteristic odour of duck eggs. It may not be difficult to surmount this somewhat minor difficulty through promotional activities. It is likely that the odour problem of duck

eggs may be solved either through alterations in the management and dietary of the birds or by chemical treatment of eggs. This is a subject worthy of scientific investigation.

31.9.3 Besides being a profitable source of egg and meat production, the raising of ducks may render several other important incidental benefits. While foraging in the crop fields or gathering food in ponds, ducks may help in increasing the fertility of the soil as well as of the ponds through their droppings, which supplement plant and fish nutrition respectively. According to an estimate, the additional annual fish production amounts to $\frac{1}{4}$ kg per duck. The number of ducks/ha of water should not, however, be allowed to exceed 250, otherwise excess of organic manure could cause more damage than good. Ducks feed on a large variety of organisms like snails, fish, flies, earthworms, insects, etc. that are vectors of diseases. Thus, the rearing of ducks may serve as effective biological control of a number of human and animal diseases. Ducks not only destroy the disease vectors but also by consuming the organisms as food convert those into edible eggs and meat.

Duck Farming

31.9.4 The natural habitat of ducks are the swampy regions and duck farming may play an important role in the agrarian economy of such areas. The rearing of ducks on dry land is possible but dry land duck farming cannot stand in competition with poultry farming in these regions. Because of natural predilection for water, ducks are mostly concentrated in the eastern and southern States and are very popular in those areas of the States where swamps, ponds, pools and marshes abound.

Duck Development

31.9.5 It is rather unfortunate that even though duck rearing is capable of bestowing considerable financial benefits and better nutrition to a vast population of the financially weaker sections of the society in regions with abundant waterlogged stretches of land, very little effort has so far been made to develop duck farming in an organised manner. With the drive for poultry development, poultry farming has become established in the country within a short period of time as a commercial enterprise. In contrast, developmental activities for duck farming have remained sadly neglected.

31.9.6 As mentioned in paragraph 31.2.1, it was only as late as 1961 that the poultry population was classified in a manner that provided

some information on duck population separately from other types of poultry. But this information is of little value as the classification was followed only in a few States. During the next census in 1966, separate classification of ducks was followed in all the States barring Nagaland and the estimate on duck population was more dependable. According to this census, the total duck population in the country comprises over 9.7 million. Table 31.2 gives the distribution of ducks in different States of the country in 1966.

TABLE 31.2

Duck Population (Statewise) in 1966¹

Andhra Pradesh	.	.	.	.	.	.	381,700
Assam	.	.	.	.	.	.	2,203,325
Bihar	.	.	.	.	.	.	286,093
Gujarat	.	.	.	.	.	.	6,352
Haryana	.	.	.	.	.	.	3,370
Jammu & Kashmir	.	.	.	.	.	.	84,478
Kerala	.	.	.	.	.	.	318,751
Madhya Pradesh	.	.	.	.	.	.	29,677
Tamil Nadu	.	.	.	.	.	.	537,910
Maharashtra	.	.	.	.	.	.	42,818
Karnataka	.	.	.	.	.	.	62,943
Nagaland	.	.	.	.	.	.	Breakdown not available
Orissa	.	.	.	.	.	.	161,388
Punjab	.	.	.	.	.	.	18,587
Rajasthan	.	.	.	.	.	.	3,887
Uttar Pradesh	.	.	.	.	.	.	64,719
West Bengal	.	.	.	.	.	.	5,330,538
A & N Islands	.	.	.	.	.	.	7,142
Chandigarh	.	.	.	.	.	.	85
Dadra & Nagar Haveli	.	.	.	.	.	.	Breakdown not available
Delhi	.	.	.	.	.	.	1,844
Himachal Pradesh	.	.	.	.	.	.	646
Lakshadweep	.	.	.	.	.	.	3,445
Manipur	.	.	.	.	.	.	33,016
Pondicherry	.	.	.	.	.	.	3,626
Tripura	.	.	.	.	.	.	104,187
all-India	.	.	.	.	.	.	9,687,527

¹ Tenth All-India Livestock Census, 1966, New Delhi, Directorate of Economics & Statistics, Ministry of Agriculture and Irrigation, Government of India.

It becomes obvious from the table that concentration of duck population is at present limited to a few States. It is only in eight States that the population of duck exceeds one hundred thousand. The largest concentration of ducks is found in West Bengal, followed by Assam, Tamil Nadu, Andhra Pradesh, Kerala, Bihar, Orissa and Tripura. In the rest of the States the population is below one hundred thousand and in some it is negligible.

31.9.7 A committee of experts was set up by the Animal Husbandry Division of the Union Ministry of Agriculture and Irrigation in 1970 to make a projection of poultry population (including ducks) and egg production five years later. According to the estimate made by this committee the duck population (females only) in 1968-69 was 4 million and egg production 400 million. The projected population and egg production during 1973-74 and 1975-76 were the same as in 1968-69. It becomes clear from the estimates of the experts committee that it envisaged a state of zero growth so far ducks were concerned. The duck development programmes under the five year plans were obviously not expected to have any countrywide impact on either duck population or egg production.

Inadequacy of Research Studies

31.9.8 Neglect in the development of duck farming becomes obvious from the fact that hardly any research work has so far been undertaken in the country to study and gather basic information on various aspects of duck husbandry. Various research projects that were sponsored by ICAR and other agencies for investigation of poultry have been mentioned in section 4 on Breeding. But there has been none so far on problem of duck rearing. No attempt has also been made to identify and classify the different breed types among the stock of native ducks. As a consequence, there are at present very large gaps of knowledge in practically all aspects of duck husbandry. In consideration of the important role that duck farming can play in improving the rural economy in vast areas in some of the eastern and southern States, there is an urgent need to know a great deal more about ducks. We, therefore, recommend that systematic research investigations on various aspects of duck husbandry should be undertaken on a priority basis in States where ducks constitute an important species of poultry and where there are good prospects of duck development. We further recommend that initially some of these research projects should be sponsored by the ICAR. Subsequently, the agricultural universities in the States concerned with development of ducks should sponsor such research studies. The National Avian Research Institute, the establishment of which has been proposed in paragraph 31.10.2 in the following section on Research and Education, should undertake research studies on ducks that require its attention.

Duck Development Programmes

31.9.9 It is only as late as during the Second Five Year Plan 6 M of A&I/76—19

period that a planned, small-scale duck development programme was initiated in the country. During this period a few Duck Extension-cum-Demonstration Centres were established with a view to propagating good quality ducks and for providing training facilities to the farmers. In the next Plan period one regional duck breeding farm was established at Haringhata, West Bengal, with importation of 3,000 Khaki Campbell ducklings from Holland. One objective was to acclimatise and multiply ducks of the exotic breed in large numbers and to distribute high egg-laying ducks to other State farms. Another objective was to supply hatching eggs to the farmers for improving their indigenous ducks by crossing with exotic stock. The programme also aimed at gaining experience in the rearing of superior quality ducks of exotic breed. The objectives remained unfulfilled because of an outbreak of hepatitis, possibly of viral origin, which virtually wiped out the entire flock of ducks. Though it was a serious setback, the importance of development of duck farming in bettering the rural economy in a number of States, induced the planners to approve of making fresh attempts at establishing large size duck farms with imported superior quality stock. Accordingly, 8,190 Khaki Campbell ducklings were imported in 1971 from England and supplied to Assam, Andhra Pradesh, Haryana, Jammu and Kashmir, Kerala, Orissa and West Bengal. We are informed that this attempt has met with some success. Initially, there were some mortalities among the ducklings due to delay in transportation, brooding problems, fungus infection and hepatitis but after these problems were overcome, the flocks were doing well and multiplying rapidly in a few States. There are proposals for strengthening and enlarging, during the Fifth Five Year Plan, duck breeding programme initiated earlier. It has been reported to us that the Central Government have decided to establish a Central Duck Breeding Farm under the direct technical and administrative control of Union Ministry of Agriculture and Irrigation. We are in full agreement about the necessity of developing duck farming in the States where the ducks are an important source of income to the farmers. But, we feel that the programmes as are now being pursued may not yield successful results and may end in failure unless there is a reorientation and a change in approach in the execution of the programmes. From the information that we have been able to gather, it is obvious that only the expertise and know-how of backyard duck farming with indigenous stock in small flocks that the farmers possess are at present available in the country. But no expertise and know-how required for successful operation of large sized duck farms with superior quality exotic stock exist at present in India. These have to be developed. For the development of necessary expertise, we suggest that systematic studies should be taken up at the proposed Central Duck Breeding

Farm on breeding, nutrition, management and disease incidence so that effective husbandry practices may be developed. It has been reported to us that the Central Government is deputing some poultry officers to Hungary for undergoing training in duck rearing and management. In view of complete lack of technical know-how of modern methods of duck rearing, we feel that it would be desirable to approach some international agencies for making available outside expertise to help build up duck farming in the country on modern scientific lines.

10 RESEARCH AND EDUCATION

Research

31.10.1 The very fast growth of poultry farming in the country during the last decade or so has transformed it into an agro-industry. According to an FAO poultry production expert¹ the output from poultry production in India has increased from Rs. 585 million in 1961 to Rs. 1754 million in 1971 and thus recording a spectacular growth of more than 200 per cent during a decade. This fast growth rate, though somewhat slowed down recently due to shortage of feed ingredients, has been sustained to a considerable extent.

31.10.2 All progressive industries require a research support matching the size and importance of the industry. The present stage of poultry industry requires that expertise is available in adequate measure in the country for undertaking all specialised activities concerned with it. This would only be possible if due support is given to the industry by various research and developmental organisations. The research support to the poultry industry at present is mainly given by the ICAR. As mentioned in paragraph 31.3.2, one of the turning points in the history of poultry development in India was the establishment of Poultry Research Division at the IVRI. It must be admitted that this Division has contributed significantly to the growth of the industry. But the magnitude and complexity of problems faced by a fast growing industry like the poultry industry cannot be handled by the extent of research support now being given by the Poultry Research Division of the IVRI and a few agricultural universities. In such a situation, proposal for a national research institute for poultry including ducks, turkey etc. appears very reasonable to us. The examples of the

¹ Indian Poultry Industry Yearbook. 1973. p. 19. Shakuntala Gupta, 2C/34, New Rohtak Road, New Delhi-5.

National Dairy Research Institute and the Central Sheep and Wool Research Institute in the realm of animal husbandry or the Central Potato or the Central Tuber Crops Research Institute in the realm of crops come to our mind. We, therefore, recommend that a National Avian Research Institute (NARI) dealing with all species of poultry and allied subjects may be established. When the NARI is set up, the present Poultry Research Division of the IVRI and the CTIPP&M at Hessarghatta may form constituent units of the Institute.

31.10.3 The functions of NARI will be to undertake suitable research projects and to impart training in various disciplines of science at the post-graduate level. The objectives of the Institute should be so formulated that it may bring in its fold all aspects of research and training on different species of poultry. The type of research work now in the hands of the CPBP and the AICRP referred in paragraphs 31.4.14 and 31.4.27 respectively, should, in due course of time, be taken over by the NARI as one of its permanent programmes. The Germplasm Banks, establishment of which we have recommended in paragraph 31.4.34 would be very suitable as Regional Research Centres of the proposed NARI. While the agricultural universities and other research laboratories of State Governments will be engaged in research mainly on local problems, the primary functions of the NARI would be to handle problems of national importance and those that concern a number of contiguous States. The Institute will arrange to have effective cooperation and collaboration with not only the research institutes within the country but also with other research institutes abroad.

Education

31.10.4 While there is urgent need to create a sound research base for the poultry industry, this base must have a strong foundation in a well conceived plan of education in poultry science. A number of pre-university level poultry training programmes are at present being pursued by various teaching institutions in India. Some of these training courses are serving a useful purpose by fulfilling local needs. At the same time, the quality and standard of training in some of the courses are so poor that they should better be discontinued. At the Bachelor's degree level, all the education in poultry science that a student can obtain at present is what he gets as a very small part of Bachelor's degree course in Veterinary Science and Animal Husbandry or a degree course in Agriculture. This is far too inadequate for properly training the persons who would be required for manning the specialised branches of poultry industry. We recommend that agricultural universities in the States, particularly where poultry constitutes

an important part of agro-industries, should have separate Poultry Science Departments. In Section 7 on Education and Training in Animal Science of Chapter 53 on Education we have recommended a reorganisation of education in animal science, which if implemented, would to a great extent remove the deficiencies existing at present in education and training in poultry science at the university degree level.

11 SUMMARY OF RECOMMENDATIONS

31.11.1 The main recommendations made in this chapter are given below :

1. Steps should be taken for obtaining sexwise classification of poultry population and breedwise breakdown of imported fowls during livestock censuses so that more effective poultry development plans may be drawn up.

(Paragraphs 31.2.1 and 31.2.5)

2. Research should be continued and expanded for development of methodology to obtain reliable information on all aspects of poultry farm economics.

(Paragraphs 31.2.3 to 31.2.5)

3. The existing organisations for livestock statistics in the States should be strengthened for conducting regular, periodic intercensus sample surveys. The statistical cell in the Union Ministry of Agriculture and Irrigation needs strengthening to effect necessary coordination and provide guidance to the State organisations.

(Paragraphs 31.2.4 and 31.2.5)

4. Hybrid chicks should be produced locally in adequate numbers out of breeding stock developed indigenously. The quality of hybrid chicks produced should be of a standard equal to or better than that achieved by the franchise hatcheries.

(Paragraphs 31.4.4 to 31.4.7)

5. Remedial measures are necessary to remove the constraints standing in the way of proper execution of the Coordinated Poultry Breeding Project of the Government of India. The project should be remodelled as a National Coordinated Poultry Breeding Project. Persons in charge of important breeding projects should not be transferred during the tenure of the project. If necessary such persons should be retained in position with proforma promotion.

(Paragraphs 31.4.13 to 31.4.22)

6. The Central Poultry Breeding Farm at Hessarghatta should serve as the Central unit of the proposed National Coordinated Poultry

Breeding Project and the officer-in-charge of the farm at Hessarghatta should function as the Project Coordinator.

(Paragraphs 31.4.23 to 31.4.25)

7. The stock developed under the All India Coordinated Research Project (Poultry) of the Indian Council of Agricultural Research should be regularly subjected to the Random Sample Tests conducted at Hessarghatta.

(Paragraph 31.4.29)

8. The ICAR should initiate a programme to collect and preserve native fowl germplasm resources.

(Paragraph 31.4.33)

9. Central Germplasm Banks should be created in different agro-climatic regions for maintaining large populations of distinctly identified strains/lines of poultry as also indigenous fowls under the control of a Standing Committee on Poultry Development (SCPD).

(Paragraphs 31.4.34 and 31.4.35)

10. Test sample size should be increased to at least 60 pullets per entry per test centre to attain greater accuracy in Random Sample Tests (RSTs) for egg-laying. RSTs should be conducted under the control of the SCPD to generate confidence among the participants.

(Paragraph 31.4.37)

11. Work on RSTs in broilers should be extended at Hessarghatta and this facility should be developed at the other regional RST units when established. Besides testing the commercial broiler chicks the breeder flocks should also be subjected to test.

(Paragraph 31.4.38)

12. All commercial hatcheries should be licensed to ensure maintenance of high quality of the stock. Extensive field trials should be required to be given to a commercial strain before it is released for general sale by a hatchery. The reliability of the claim of performance of a stock and its suitability for release for sale should be decided by the SCPD.

(Paragraph 31.4.39)

13. Chick-sexing training courses should be organised on a regular basis. To ensure high quality of training it may be desirable to send a few suitably qualified persons abroad for advanced training. Persons trained in chick-sexing should appear in an examination every three years for recertification of their competence.

(Paragraph 31.4.41)

14. Steps should be taken to incorporate autosexing genes in the stocks being developed under the Central Government and ICAR poultry breeding projects.

(Paragraph 31.4.41)

15. Broiler production programmes should be taken up around all the seventeen poultry dressing plants on a priority basis. Around each of the fifteen 1,000 bird dressing plants located in or near the IPDP Centres, a poultry farmers' cooperative with hundred members should be formed. The broiler production programme should be so arranged as to enable two members to supply one day's full requirement for the plant. The broiler dressing should be undertaken for 200 days of a year whereas for 100 days, dressing and processing of culled hens from egg producers should be undertaken in these plants.

(Paragraph 31.4.43)

16. The IVRI and the Central Food Technological Research Institute should attempt at evolving a cheap process of cooking and packing of meat from hens that are sold as table birds after the laying period. The process evolved should be easily operable even under rural conditions.

(Paragraph 31.4.43)

17. High producing straincross or incross hybrid chicks should be reared in places where high standard of poultry husbandry exists.

(Paragraph 31.4.45)

18. Where poultry husbandry has not attained a high standard, but is at the intermediate level, exotic crossbred chicks should be raised.

(Paragraph 31.4.45)

19. For backyard poultry keeping in rural areas, crossbred cocks obtained either by crossing White Leghorn males and Rhode Island Red females or White Leghorn males and Australorp females, should be used for grading up the indigenous stock.

(Paragraph 31.4.45)

20. Poultry estates should be established in selected localities in different States and Union Territories for providing employment to the educated unemployed and for rehabilitation of the physically handicapped.

(Paragraph 31.4.46)

21. Agricultural universities in orchard growing States should undertake studies on the economics of poultry keeping in orchards and determine the optimal conditions of poultry raising under this system.

(Paragraph 31.4.47)

22. Poultry production through SFDA/MFAL projects should be organised following the recommendations made in the Interim Report of the National Commission on Agriculture on Poultry, Sheep and Pig Production through Small and Marginal Farmers and Agricultural Labourers for Supplementing their Income. Every effort should be made to implement the programme in all the 167 districts identified for

this purpose at least by 1985, if not earlier.

(Paragraphs 31.4.48 and 31.4.49)

23. Till the stage is reached by 2000 AD when there should not be any shortage of grains for poultry feeding, attempts should be made to procure ingredients of poultry feeds at reasonable cost and to use industrial byproducts in greater measure. Extensive studies should be undertaken for greater use of agro-industrial byproducts in poultry feeds.

(Paragraphs 31.5.5, 31.5.6 and 31.5.10)

24. Inedible marine animals or marine animals like mussel, for which there is no local market, should be explored as an alternative source to meet the shortage of supply to the fish meal plants.

(Paragraph 31.5.8)

25. Sterilised meat and blood meal and silk worm pupae meal can replace fish meal to a considerable extent in compounding poultry feeds and steps should be taken for increased production and use of these materials.

(Paragraph 31.5.9)

26. A few dehydration plants should be set up in selected places to make pilot studies on the manufacture of lucerne and berseem meals for inclusion in poultry feeds as well as on their economics.

(Paragraph 31.5.11)

27. Investigations on least cost formulation of balanced poultry feeds should be undertaken on an extensive scale.

(Paragraph 31.5.12)

28. Raw materials of standard quality should be made available at controlled rates to the poultry equipment manufacturers on recommendations of the Centre/State Animal Husbandry Departments.

(Paragraph 31.6.1)

29. Veterinary Departments should create a cadre of veterinarians specially trained in poultry diseases to provide effective health cover to the poultry farms.

(Paragraph 31.7.1)

30. Early action should be taken to introduce licensing of commercial hatcheries under suitable legislation in consideration of disease hazards. The licences should be granted only by the Central Government on recommendation of the SCPD.

(Paragraph 31.7.2)

31. For imparting special training in poultry diseases to the veterinarians, agricultural universities should introduce special inservice training courses during the summer vacation.

(Paragraph 31.7.3)

32. Action should be taken to enable landless labourers and small

and marginal farmers to obtain loans on personal surety expeditiously, but it should be ensured that the loans are given only to bonafide farmers and landless labourers.

(Paragraph 31.8.3)

33. Multitiered structure of poultry farmers' cooperatives should be organised on the lines recommended in our Interim Report on Poultry, Sheep and Pig Production through Small and Marginal Farmers and Agricultural Labourers for Supplementing their Income.

(Paragraphs 31.8.5 to 31.8.9)

34. Market survey studies should be taken up at regular intervals to collect information on the factors influencing the pricing of eggs and other poultry products. Extensive research on processing and packaging of poultry products should also be taken up early for promotion of poultry industry.

(Paragraph 31.8.11)

35. All the four proposed Regional Cooperative Marketing Federations of the National Egg and Poultry Products Marketing Federation should be fully equipped for quick disposal of eggs. This organisation may enter into agreements with milk drying plants to manufacture egg powder.

(Paragraphs 31.8.14 and 31.8.15)

36. The State Animal Husbandry Departments should launch a massive drive to educate poultry farmers in producing clean and infertile eggs.

(Paragraph 31.8.16)

37. Preliminary work relating to the establishment of the National Egg & Poultry Products Marketing Federation should be completed expeditiously. State Marketing Federations should be set up quickly where these do not exist.

(Paragraph 31.8.17)

38. As a practical solution to the prevailing problem of marketing of eggs during summer, the egg production programme may be modified both in the rural and urban areas.

(Paragraph 31.8.18)

39. Research studies should be undertaken to find out if the peculiar odour problem of duck eggs could be eliminated through alterations in the management and dietary of the birds or by chemical treatment of eggs.

(Paragraph 31.9.2)

40. Systematic research investigations should soon be initiated on various aspects of duck husbandry in the States where ducks constitute an important species of poultry. Initially the ICAR should sponsor such research projects. Subsequently the agricultural universities

of concerned States may pursue studies on different problems of duck husbandry.

(Paragraph 31.9.8)

41. To develop the expertise required for operation of large-size duck farms with superior quality exotic ducks, systematic studies should be undertaken on different aspects of duck husbandry in the proposed Central Duck Breeding Farm.

(Paragraph 31.9.9)

42. Some international agencies should be approached for making expertise available for building up duck farming in the country on modern scientific lines.

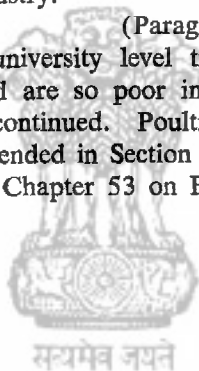
(Paragraph 31.9.9)

43. A National Avian Research Institute dealing with all species of poultry and allied subjects should be established to give research support to the poultry industry.

(Paragraphs 31.10.2 and 31.10.3)

44. Some of the pre-university level training courses in poultry science now being offered are so poor in standard and quality that they should better be discontinued. Poultry science education should be reorganised as recommended in Section 7 on Education and Training in Animal Science of Chapter 53 on Education.

(Paragraph 31.10.4)



APPENDIX 31.1

(Paragraph 31.4.19)

*The Results of the Random Sample Tests

Average performance of the entries participated in more than one test :

In order to provide information of greater reliability arithmetic averages of major characters of economic importance are presented. These figures are for 11 months tests. If one wished to estimate for 12 months lay, 14—18 eggs may be added.

Sl. No.	Name of entry and address	Hen housed lay	Hen day lay	Kilos feed used per dozen of eggs	Feed consumption per day	Average egg weight (g)	Margin over feed cost only, from sale of eggs, birds and deep litter	Average based on number of years entered
		1	2	3	4	5	6	7
							Rs. P.	
White Egg Layers								
1.	Central Poultry Farm, Hessarghatta (Govt. of Karnataka)	208.0	218.5	2.22	116	54.1	25.74	4
2.	Central Poultry Breeding Farm (G.O.I.), Bombay.	186.9	204.1	2.39	111	53.5	21.72	4
3.	M/s. Universal Poultry Breeding Farm (Unichix), New Delhi	193.3	210.5	2.24	110	54.0	23.72	4
4.	Central Hatchery, Chengannur (Govt. of Kerala)	188.7	204.6	2.42	115	55.3	21.01	4
5.	Central Poultry Breeding Farm (G.O.I.), Hessarghatta	221.3	225.4	1.96	106	50.1	30.51	3
6.	Govt. Poultry Farm, Bhopal (Madhya Pradesh)	181.5	206.4	2.35	111	53.0	22.27	3

* Reproduced from the Final Report of the Fourth Random Sample Test for Eggs Production 1973-74 conducted at Hessarghatta—Bangalore (Karnataka) March 10, 1973—July 31, 1974.

APPENDIX 31.1 (Contd.)

	1	2	3	4	5	6	7
7. Regional Poultry Farm, Patancheru, A.P.	187.4	199.3	2.20	105	53.3	24.87	3
8. District Live-stock Farm, Hosur	169.3	190.0	2.42	105	52.5	18.58	3
9. Rani Shaver	194.6	222.1	2.25	108	54.65	23.39	2
10. Arbor Acres	180.9	219.6	2.46	111	53.9	19.19	2
11. Premier Poultry Farm (Thornber)	193.8	221.6	2.11	113	52.4	28.87	2
12. Kegg Farms (Key Stone)	177.8	198.5	2.13	120	54.2	23.87	2
13. Govt. Poultry Farm, Gurudaspur, Punjab	184.5	210.0	2.35	106	51.3	20.75	2
14. Govt. Poultry Farm, Jaipur	175.9	196.6	2.31	110	52.2	23.96	2
Brown Egg Layers							
(a) Pure Breeds							
15. Central Poultry Breeding Farm (Govt. of India), Hessarghatta (Australorps)	53.0	173.2	3.08	117	58.8	12.41	2
16. Central Poultry Breeding Farm (Govt. of India), Bombay (Australorps)	147.8	158.6	2.98	110	58.2	11.90	2
17. Central Poultry Breeding Farm (Govt. of India), Bhubaneswar (R.I.R.)	180.2	188.7	2.57	116	54.1	17.81	2
(b) Breed Cross							
18. Central Poultry Breeding Farm, Hessarghatta (Govt. of India) (WL × AO)	202.6	224.6	2.14	111	51.7	26.54	3
19. Central Poultry Breeding Farm (Govt. of India), Bhubaneswar (WL × RIR)	179.2	206.2	2.24	107	54.8	23.06	2
20. Egg Line Poultry Farm, Meerut (WL × RIR)	207.0	219.7	2.15	113	52.85	30.01	2
21. Central Poultry Breeding Farm, (Govt. of India) (WL × AO)	182.7	217.7	2.43	111	53.75	20.56	2

OTHER LIVESTOCK

(PIG, EQUINES, CAMEL AND YAK)

We have dealt with cattle and buffaloes in Chapter 28, sheep and goats in Chapter 30 and poultry in Chapter 31. Pig, equines, camel and yak are dealt within this Chapter.

1 PIG

32.1.1 Pig is one of the most efficient feed converting animals among domesticated stock. It is the only litter bearing animal among meat producing livestock having the shortest generation interval and high feed conversion efficiency. The total production of pork in the country was of the order of 53,000 tonnes¹ in 1973. Pork constituted 7.4 per cent of total meat production during the three calendar years 1971 to 1973. We feel that the ratio of pork production to total meat production will move in favour of the former in the years to come. An idea of the likely demand which will develop for pork and the production programmes necessary to meet this demand has been presented later in this Section in paragraph 32.1.19.

32.1.2 Pig rearing fits in very well with mixed farming and can also be complementary to intensive crop production operations. In India, pig farming has a special significance as it can play an important role in improving the socio-economic status of a sizeable section of the weaker rural community. For a long time, pig rearing has, by and large, remained confined in the hands of this class of people. These traditional producers do not possess the technical know-how of pig production on modern lines and the infrastructure necessary to provide them the required facilities is also not in existence at present. With the adoption of improved pig rearing practices applicable under rural conditions, there will be significant increase in the income of some of

¹ FAO Production Year Book, 1973.

the poorest people in the country who traditionally rear pigs.

32.1.3 Pig farming as a commercial venture is still to be established in the country. It remained neglected for long because of a general apathy against this occupation. Furthermore, many constraints like insufficient availability of high quality stock, balanced feeds at economic prices and absence of favourable market conditions hampered pig production. Before the Second Five Year Plan, virtually no attempt was made to popularise pig rearing on scientific lines.

Population and Production Trends

32.1.4 The population of pigs in India as enumerated in the 1951 and subsequent livestock censuses is as follows :

Year	Pig population (million)
1951	4.4
1956	4.9
1961	5.2
1966	5.0
1972	6.5

It can be seen from the above that pig population remained more or less stationary from 1951 to 1966. The population of 6.5 million in 1972 constitutes a growth of 28 per cent over that of 1966.

32.1.5 The Statewise breakup of pig population in 1966 and 1972 is given in Table 32.1. In 1972, there was an increase in pig population in all the States except Himachal Pradesh, Madhya Pradesh and Punjab. The maximum increase in numbers in West Bengal followed by Bihar, Orissa, Uttar Pradesh, Tamil Nadu and Andhra Pradesh in that order.

TABLE 32.1

Pig Population of India (1966 and 1972)¹

States	1966	1972	(Thousand)	
			increase or decrease	
			Col. 3-2	% w.r.t. 1966
1	2	3	4	5
Andhra Pradesh	582	690	+108	+18.5
Assam	264	330	+66	+25.0

¹ Eleventh All India Livestock Census—1972.

1	2	3	4	5
Bihar	646	879	+ 233	+ 36.0
Gujarat	2	8	+ 6	+ 300.0
Haryana	100	143	+ 43	+ 43.0
Himachal Pradesh	3	3	0	0
Jammu & Kashmir	@	1	..	..
Karnataka	207	280	+ 73	+ 35.2
Kerala	112	129	+ 17	+ 15.2
Madhya Pradesh	378	343	- 35	- 9.2
Maharashtra	181	203	+ 22	+ 12.1
Manipur	74	134	+ 60	+ 81.1
Meghalaya	108	127	+ 19	+ 17.6
Nagaland	111	184	+ 73	+ 65.7
Orissa	180	387	+ 207	+ 115.0
Punjab	45	38	- 7	- 15.5
Rajasthan	83	117	+ 34	+ 42.1
Tamil Nadu	475	584	+ 109	+ 22.9
Tripura	37	44	+ 7	+ 18.9
Uttar Pradesh	1,162	1,302	+ 140	+ 12.0
West Bengal	143	378	+ 235	+ 164.4
Union Territories	142	152	+ 62	+ 68.8
all-India	5,035	6,456	+ 1,421	+ 28.2

@ less than 500.

32.1.6 At present the only source of pig population statistics is the quinquennial livestock census. No study has so far been undertaken to estimate the size of population during intercensus periods. For formulating effective pig developmental programmes for different areas it is necessary to have information on regional changes in the size and composition of population in terms of indigenous, crossbred and exotic stock from time to time. To meet this requirement, we recommend that the Institute of Agricultural Research Statistics (IARS) should develop proper sample survey techniques for obtaining dependable population estimates during intercensus periods. Livestock census at present only indicates the total pig population in a State. It does not indicate the classifications relating to age, sex and type like indigenous, crossbred or exotic breeds to which the animals belong. Without such information effective planning for piggery development is difficult. Immediate steps should, therefore, be taken so that during the future livestock censuses information is collected at least on the types of pigs like indigenous and improved and on broad age classification of adult and the youngstock on a sample basis.

32.1.7 Available data on economics of pig farming in India is at present very scanty. Information on this aspect is equally important for making realistic planning. The IARS had, sometime ago, made some pilot studies on economics of milk production in the country under different husbandry practices. We recommend that the Institute should undertake on a priority basis a number of similar research investigations on the economics of pig production.

32.1.8 Piggery development work is seriously handicapped by almost a total lack of production statistics. The only estimate of pork production available for a long time was that from the report of the Directorate of Marketing and Inspection (DMI) on Marketing of Meat in India (1944). Subsequently in 1966-67, the DMI conducted an *ad hoc* survey on the marketing of pork and pork products. According to this survey, the production of pork and pork products was estimated at 50,000 tonnes per year. Estimates of statewide production and per capita consumption of pork made on the basis of the above survey are shown in Table 32.2.

TABLE 32.2

Estimated Annual Production and Per Capita Consumption of Pork

State	No. of pigs § (1966)	No. of pigs slaughtered (1967-68)	Produc- tion of pork (tonnes)	Per capita consump- tion (in g)
	(thousand)	(thousand)		
Andhra Pradesh	582	155	4,216	98
Assam	264	132	3,590	250
Bihar	646	115	2,611	45
Gujarat	2	1	26	2
Haryana	100	22	999	66
Himachal Pradesh	3	2	73	291
Jammu & Kashmir	@	Neg.	Neg.	Neg.
Karnataka	207	61	1,751	66
Kerala	112	41	1,106	58
Madhya Pradesh	378	170	4,709	127
Maharashtra	181	88	2,306	54
Manipur	74	22	570	573
Meghalaya	108	N.A.	N.A.	N.A.
Nagaland	111	35	952	573
Orissa	180	30	1,020	44
Punjab	45	25	1,135	74
Rajasthan	83	5	152	6
Tamil Nadu	475	130	3,133	85
Tripura	37	10	337	176
Uttar Pradesh	1,162	280	10,164	125
West Bengal	143	215	9,698	240
Union Territories	142	54	1,799	414*
total	5,035	1,593	50,347	103

§—All India Livestock Census 1972

@—Less than 500

N.A.—Not available

Neg.—Negligible

*—Denotes Delhi only

32.1.9 Among the important pork producing States, Uttar Pradesh is foremost followed by West Bengal, Madhya Pradesh, Andhra Pradesh, Assam and Tamil Nadu. Among the Union Territories, Delhi produces 1,360 tonnes per year followed by Goa, Daman and Diu where pork production is estimated at about 226 tonnes. The per capita consumption of pork is highest in Nagaland and Manipur followed by Himachal Pradesh, Assam, West Bengal, Tripura, Madhya Pradesh and Uttar Pradesh. No inference can, however, be drawn from these data concerning the factors influencing production and consumption, as information is not available on social acceptability of pig and pork products, food habits of people and their economic status, marketing organisation etc., that greatly influence both consumption and production. In general, the price of pork is lower than that of mutton but in the Eastern States due to high demand for pork, low local production and high transport costs, its price is higher. More recently (1974), in a survey¹ conducted by the Progressive Agro-Industrial Consultants at our instance, it was observed that in metropolitan cities like Bombay, Calcutta and Delhi, there has been a sharp increase in the consumption of pork and pork products. An increase in production of sophisticated products by private sector enterprises was also recorded.

32.1.10 The information on production and consumption of pork and pork products is at present entirely dependent on *ad hoc* surveys. Moreover, no estimate has so far been made on the existing demand for pork and pork products in the country. Surveys should be conducted at regular intervals for determining the demand, consumption and supply of pork and pork products following proper statistical techniques.

32.1.11 There are, however, some inherent difficulties in conducting such surveys to obtain reliable information, viz.,

- (i) vast majority of pig farmers are illiterate and are unaware of the importance of maintaining proper farm records;
- (ii) the pig population is scattered and isolated in small herds ;
- (iii) absence of licensed pig slaughter houses and sale yards ; and
- (iv) most of the slaughter in the rural and even in some urban areas is done in a clandestine manner and the meat is consumed locally without passing through any organised market.

As a useful step which, besides giving other advantages, would improve the reliability of data on production and consumption of pork, we

¹ Pork and pork production in India. A report of the survey made by the progressive Agro-Industrial Consultants. pp. 45-51. 1974.

recommend that all the cities and big towns where pigs are slaughtered regularly, should have arrangements for licensing of pig slaughtering. The slaughter houses should maintain proper records on the number of pigs slaughtered, live weight, dressing percentage etc. Suitable sampling techniques should be evolved by the IARS to find out the number of pigs slaughtered in rural areas. The surveys on pork and pork products have been conducted by the DMI with inadequate technical staff. To conduct surveys at regular intervals, we recommend creation of a suitable cell in the DMI for regular periodic surveys on livestock and livestock products.

Piggery Development During the Plan Periods

32.1.12 Before the introduction of five year plans, except for some sporadic import of a few superior quality pigs of exotic breeds by a few missionary organisations, no concerted or organised measures were taken to improve pig production in the country. In the First Five Year Plan no attention was given to pig development. During the Second Five Year Plan, however, pig production attracted some attention and a Coordinated Pig Development Programme was launched. Under this programme schemes were drawn up for establishment of bacon factories, Regional Pig Breeding Stations, Pig Breeding Farms/Units and Piggery Development Blocks. These schemes were further extended during the subsequent Plan periods. Piggery Development Scheme was strengthened by a special development programme taken up at the end of the Third Five Year Plan. In preparing a model scheme for this programme, the Central Government rightly took the decision of attaching the Regional Pig Breeding Stations to the bacon factories. The Subgroup on Piggery Development constituted by the then Ministry of Food and Agriculture rightly pointed out the need of detailed market survey before selecting the sites for bacon factories. The number of Stations/Units/Farms/Blocks set up during the different Plan periods were as follows :

	Bacon factories	Regional pig breed- ing sta- tions	Pig breed- ing units/ farms	Piggery develop- ment blocks
Second Plan	2	2	15	33
Third Plan	6	5	37	107
Fourth Plan			3	
total	8	7	55	140

The primary objective of the Regional Pig Breeding Stations was to acclimatize and further improve the breeding stock of exotic pigs

through selective breeding for distribution to pig breeding farms/units for further multiplication. A secondary objective was to supply pigs to the bacon factories from culled or surplus stock. A total of 404 exotic pigs have been imported so far vide Appendix 32.1. The pigs produced at the breeding farms/units were to be distributed in compact rural areas for grading up the local stock. The bacon factories were to provide ready and remunerative markets for pigs raised and to produce for sale, pork and pork products under ideal hygienic conditions. About 12,000 improved pigs were distributed to the farmers up till 1972. The distribution of these pigs in different States can be seen from the figures given in Appendix 32.2.

32.1.13 The organisation of pig production in rural areas has been concentrated particularly around the bacon factories. Eighteen officers have been trained abroad in pork production and bacon factory technology and expert help of two FAO consultants was obtained to plan for augmenting pork production and to develop pork and pork product technology in the country.

32.1.14 Establishment of eight bacon factories during the Second and Third Plan periods was the beginning of an attempt made for making wholesome pork and pork products available to the consumer. The details regarding the location and installed capacities of these factories, are given below :

Bacon Factories and their Installed Capacities (1972-73)

Name of the factory	Capacity per day (pigs)
Bacon Factory, Gannavaram, Krishna District, Andhra Pradesh	100
Bacon Factory, Borivili, Bombay, Maharashtra	100
Bacon Factory, Haringhatta, Mohanpur, Nadia District, West Bengal	10-20
Bacon Factory, Central Dairy Farm, Aligarh, U.P.	100
Bacon Factory, Kuthattukulam, Ernakulam District, Kerala	50
Bacon Factory, Kanke, Ranchi, Bihar	50
Pork Processing Plant, Kharar, Punjab	10-20
Bacon Factory, Alwar, Rajasthan	50

None of the bacon factories are working even at fifty per cent of the installed capacity at present. The Progressive Agro-Industrial Consultants conducted a study on Pork and Pork Production in India for us in 1974. The following are their findings on the effectiveness of the various infrastructures created by the public sector bacon factories :—

- “(i) The pig breeding station, started as a supply base to the modern producers, revealed various degrees of under utilisation of their installed capacity. While at Haringhatta,

the capacity utilisation was about 30 per cent, at Borivili it was about 28 per cent and at Aligarh hardly 25 per cent.

- (ii) The position deteriorated further in the last two years by the severe incidence of swine fever and foot and mouth diseases. At Borivili and Haringhatta, these diseases took a heavy toll and led to a 40 per cent reduction in stock. Although this loss was beyond the control of the management, part of it was undoubtedly attributable to the lack of adequate health cover and prophylactic measures.
- (iii) The system of supply of gilts, boars, sows and baconers from the breeding stations and the wider dispersion of recipients shows that there was hardly any perspective in view. In some cases, supplies were allowed not only to different parts within the State but also outside the State. But in many cases, the supplies to modern producers were not intensive enough to saturate a particular zone and pave the way for the building up of a viable service superstructure in selected areas.
- (iv) The crossbreeding programme was found to be generally ineffective except in UP where 12 Boar centres were set up around Aligarh Bacon Factory, although the bacon factory itself was not the net beneficiary of this programme. It, however, appears that the other bacon factories did not foresee the urgency for the grading up of indigenous stock to meet the increasing demand for pork and pork products. Even now, there is some resistance by a few factories to accept crossbred animals.
- (v) The selection of modern producers was also made more or less at random without sufficient consideration to the concept of a compact block or to locational advantages and factor endowments. Initially, there was considerable response from genuine entrepreneurs who were young and educated, but nearly 85 per cent of the modern producers have lately closed down their operations.
- (vi) The farmers' training programme was conceived as a pre-service training programme for a duration of 3 months. The time schedule and the curriculum for training seem to be adequate. However, the opportunity for such training was mainly availed of by Government staff who accounted for more than 60 per cent of the total number of passed trainees at Haringhatta and 75 per cent at Aligarh. This training programme was discontinued from 1965 at Aligarh and from 1971 at Haringhatta.

- (vii) The selection of farmers for training was made through BDO*, DAHO† and similar other officers. Some of the selected farmers looked for salaried jobs at the end of the training programme and some left even in the middle of the programme. The selection was rather perfunctory and no serious attempt was made to test and identify proper entrepreneurs.
- (viii) Even on completion of the training programme, the farmers were not provided with the necessary infrastructure in the form of breeding stock or balanced feed or credit and marketing facilities. In fact the package concept was not followed in earnest. We have come across several instances where a farmer trained as far as 3 years back did not receive any supply of gilts and boars even though he was prepared to pay for them at approved rates.
- (ix) No attempt was made to organise inservice training courses, although the need for such a course was quite obvious for the modern producers linked up with the bacon factory.
- (x) An attempt was made to provide service infrastructure to modern producers through their own organisation and as many as 48 cooperative pig societies were set up in Maharashtra with this end in view. However, out of these 48 societies only 5 are in existence at present and of these 5 again, two have recently applied for closure. In other areas, there is hardly any organisation for the building up of infrastructure from 'below'. The real responsibility for the growth of infrastructure appears to have devolved on the State Governments (Animal Husbandry Department), Tribal Development Agency and similar other organisations.
- (xi) The failure of the Maharashtra Scheme for cooperative pig societies may be attributed, among other factors, to the wrong choice of location (sometimes about 350 miles away from the bacon factory) as well as wrong selection of entrepreneurs. In addition, credit supply from the cooperative banks was arranged without proper scrutiny of the ethics of the modern producers. In some cases, the equity capital of the societies was not fully paid up. In addition, the mode of recovery was defective and the

* Block Development Officer.

† District Animal Husbandry Officer.

transport network was inadequate. In regard to health cover and infrastructural facilities also, the organisational set up was not fully geared up to the task. Hence there was lack of a well knit chain of control and inter-agency coordination was found to be inadequate.

- (xii) The transport system was yet another instance of the lack of planning and coordination. Hardly any transport was available for the movement of stock from Kalimpong to Haringhatta. Similarly, no transport was offered by the Borivili factory to the producers at Kolhapur which was comparatively developed as a production base. Both these areas—Kalimpong and Kolhapur—are away from the bacon factories and the cost of transport through private carriage is almost prohibitive. Similar instances may be provided in other areas.
- (xiii) The same lack of planning in arranging transport facilities was noticed in Bihar. Whereas the Animal Husbandry Department of Bihar tried to help the bacon factory at Ranchi, by offering to pay for the purchase of desi animals and their transport from Purnea to Ranchi (a distance of 300 miles) there was no arrangement to lift the graded pigs from Chaibasa and Jamshedpur although the distance of these two places from Ranchi was only 100 miles, within the pigshed of the factory.
- (xiv) The system of purchase of pigs also lacked a coordinated approach or uniformity of procedure. Some factories lifted the pigs from farm heads and provided free transport; others employed contractors to purchase pigs on their behalf; in some cases, primary producers were asked to bring pigs direct to the factory gate and receive payment towards transportation costs depending on the distance covered. Some factories preferred buying carcasses.
- (xv) There were several deficiencies in the price policy as well. In the first place, the prices were fixed on the basis of live weight only without regard to the age at slaughter or the feed conversion efficiency. Secondly, there was hardly any correlation between the prices of the different breeds i.e., desi, crossbred, exotic, mainly because of the emphasis on live weights only. Variations in dressing yields and prime cuts of 'product mix' of the different breeds, were not taken into account in the fixation of their prices. Thirdly, no attempt was made to ensure a reasonable parity between purchase prices of pigs and

sale prices of pork and pork products. In several cases whereas the purchase prices were raised by only 15 to 20 per cent, the product prices were raised in quick succession by 36 to 48 per cent”.

The above findings of the Consultants highlight the problems related to the functioning of the bacon factories to full capacity. In our opinion necessary steps should immediately be taken to remove constraints in the way of taking up appropriate breeding programmes in the Regional Pig Breeding Stations attached to bacon factories, pig breeding farms and units surrounding the factories to ensure steady supply of quality pigs. Further, the bacon factories should adopt such pricing policies that would encourage the farmer to take pig rearing.

32.1.15 Though the bacon factories adopted a price policy for purchase of pigs which is linked with age and weight of the pigs, it is not helping the primary producers as the feed cost is increasing steadily. Even assuming feed conversion efficiency of 1:4, which is probably ideal in India at present (the standard in developed countries being 1:3), the feed cost per kg live weight works out to be Rs. 4 at the cost of Re. 1 per kg of feed. Generally, feed cost accounts for 75 per cent of the total cost and hence the cost of production of a kg live weight will be Rs. 5.30 and adding 10 per cent net profit to it, the cost should be Rs. 5.83. As against this, we learn that the purchase prices of pork vary from Rs. 3 to Rs. 4 per kg. Here lies the main reason for lack of enthusiasm for commercial pig production. If the commercial pig production is to be encouraged, ways and means have to be evolved for decreasing the cost of production and to pay remunerative price to the primary producers. The various procedures to be adopted for decreasing the feed cost have been suggested in paragraphs 32.1.33 to 32.1.36. The increase in sale price of pork and pork products for giving remunerative price to primary producers needs careful consideration. We learn that the demand for pork and pork products has been relatively inelastic with reference to price. This indicates that with a slight rise in prices, there will be a less than proportionate fall in demand and consequently the total revenue of the sellers will increase. However, positive cross elasticity of demand of pork and pork products with goat meat and mutton should be kept in mind. If the prices of pork and pork products increase, relative to the prices of other two varieties of meat, the demand for pork and pork products will decrease and this will adversely affect the primary pig producers. However, the reverse is also true, i.e., if the prices of goat meat and mutton increase considerably, the demand for pork and pork products will increase. The present

trend indicates the price rise in goat meat and mutton in almost every part of the country. Thus, it is expected that demand for pork and pork products will increase. Further, the survey made by the Progressive Agro-Industrial Consultants indicates that other factors remaining the same, the public sector bacon factory referred to above, could reach the break-even point only when 77 per cent (as against the existing 45 per cent) of the installed capacity was utilised. Alternatively, it was found that on the utilisation of 80 per cent of the installed capacity and the reduction of the overhead cost from Rs. 3.13 to Rs. 2.00 per kg, the factory could increase the price payable to the producers from Rs. 3 to Rs. 4.70 per kg live weight, without incurring any loss and without necessitating any upward revision in the price of the products. Necessary action can, however, be taken only if there are regular arrangements for the construction and evaluation of the relevant indicators.

32.1.16 Another constraint of major importance needs to be removed for proper pricing of the quality products by the public sector bacon factories. These factories are put to inconvenience when they are in competition with the private sector enterprises. As there is no system of quality control, no ban on clandestine slaughter and no meat control order, the private sector enterprises are free to use sub-standard material and processes. This naturally reduces the cost of inputs for private sector enterprises and as such they always have an edge over the public sector enterprises. We, therefore, strongly recommend that the private sector enterprises should be induced to buy the raw material from licensed pig slaughter houses and the system of quality control should be enforced rigidly.

32.1.17 The bacon factories should also take necessary steps to popularise their products and undertake consumer education programme.

Present Status and Need for Piggery Development

32.1.18 In spite of pig development programmes and establishment of bacon factories, pig farming has not yet become popular to any considerable extent. Consumption of pork and pork products has remained over the years very much restricted to a small section of the population. The poorest section of urban and rural communities mainly consume fresh pork and a small section of sophisticated urban population in large cities consume pork and pork products. In spite of increasing urbanisation and industrialisation of the country there has been no conspicuous difference in the consumption pattern. A trend is, however, observable that poor and middle class people are taking to

pork to a greater extent than before.

32.1.19 On the basis of available indicators of demand, we feel that the requirements of pork and pork products would be of the following order during the years 1985 to 2000 AD.

Year		Quantity of pork and pork products (million tonnes)					
1985	high	.	.	.	.	.	0.11
	low	.	.	.	.	.	0.08
2000 AD	high	.	.	.	.	.	0.17
	low	.	.	.	.	.	0.12

32.1.20 A total of 1.5 million pigs were slaughtered in 1966-67 to produce 50,000 tonnes of pork and pork products as reported by the DMI (1968)¹. Out of 1.5 million only 10 per cent were estimated to be of graded or exotic breeds and the rest were *desi* pigs. Assuming that the average dressed weight would be 45 kg in 1985 and 55 kg in 2000 AD, the number of pigs required to be slaughtered to get the amount of pork products mentioned above will be as follows :

		number of pigs to be slaughtered (million)					
1985	high	.	.	.	.	.	2.4
	low	.	.	.	.	.	1.8
2000 AD	high	.	.	.	.	.	3.1
	low	.	.	.	.	.	2.2

In calculating the above figures, it has been assumed that the carcass weight of a *desi* pig will be about 35 kg and that of a graded pig will be about 55 kg. By 1985, 50 per cent of the pigs to be slaughtered are expected to be graded. Hence out of the total 1.8 million pigs required to be slaughtered in 1985 to meet the low demand of pork and pork products, 0.9 million would be graded pigs. We have indicated in paragraph 32.1.27, that by 1985, at least 50 districts and in each district 2,000 families should be covered under SFDA/MFAL Project. If this programme is followed and if a farmer is supplied with 3 crossbred sows as per programme, it is expected that there would be 1.8 million graded pigs available by that time. It has been assumed that six pigs per sow would survive up to marketable/breedable age. From 1.8 million graded pigs, it would be possible to meet the requirement of 0.9 million marketable pigs. The production performances of both *desi* and graded pigs are expected to improve by

¹ Ad-hoc survey report on the marketing of pork and pork products in India. Directorate of Marketing and Inspection, New Sectt. Building, Nagpur.

2000 AD. It has been assumed that by 2000 AD, the carcass weight of a *desi* pig will be 40 kg and that of a graded pig will be 60 kg. To meet the demand (high) by 2000 AD, it would be necessary to produce 75 per cent of marketable pigs as graded pigs. This will be possible if our recommendation to cover all 100 districts and 2,000 families per district is implemented by 2000 AD. There is an immense need to intensify the breeding programmes to achieve the objective of having 50 and 75 per cent graded pigs by 1985 and 2000 AD respectively. This would automatically need the other necessary inputs like feed, health cover, credit and marketing. Programmes for increasing pork production would necessitate increasing research efforts on different aspects having a bearing on production. Expansion of teaching programme at different levels will similarly be required for this purpose.

Breeding

32.1.21 Pig population in the country consists mostly of indigenous non-descript types. Improved exotic stock, the number of which is small, is maintained mostly at the Regional Pig Breeding Stations and the pig breeding farms/units. Besides there are some graded pigs in organised farms and areas of intensive pig development. The indigenous pigs are generally black or dark brown in colour and vary considerably in size and type. Information on production performance traits viz., litter size at birth and weaning, growth rate, feed conversion efficiency and carcass yield in indigenous pigs is very meagre. From available reports it appears that the indigenous pigs in general attain a body weight of 30—45 kg at eighteen months of age. There are, however, some varieties available in Andhra Pradesh and some parts of Bihar that attain a body weight of 70—80 kg at the same age. The preferred marketable body weight of 90—95 kg is attained by the present day improved exotic varieties of pigs in about 5-6 month period in countries with developed pig industry. Striking contrast also exists between the indigenous and exotic stock in reproductive performances. The indigenous stock has, however, developed the quality of hardiness, being well adapted to poor rural husbandry practices and is capable of reproducing and sustaining themselves by scavenging. Up till now no programme of selective breeding for the improvement of the indigenous pigs has been undertaken except for a project initiated by the Indian Council of Agricultural Research (ICAR) at Aligarh in 1960. The objective of the project was to evolve a breed of pigs from a crossbred foundation of indigenous and Middle White Yorkshire pigs. The project has since been discontinued. Limited information that is available on indigenous pigs from observations in the

above mentioned project and the performance of some superior exotic breeds of pigs is given below :

Traits	Performance of ¹	
	Desi pigs (average)	exotic breed ¹
litter size at birth	7.52	10.44
birth weight (kg)	0.91	1.40
weaning weight (kg at 56 days)	4.15	13.57
weaning percentage	54	78.5

It is obvious from the data given above that to improve the production performance of *desi* stock to anywhere near that of exotic ones without introducing any exotic inheritance would be an impossible task within a limited period of time and reasonable investment. This is so because the heritability of reproductive traits is not high and those for the traits like body weight gain and feed conversion efficiency is only moderate. We, therefore, consider that the Central Government have rightly adopted the policy of breeding superior quality breeds of pigs in the Regional Pig Breeding Stations and the other pig breeding farms/units. The policy of grading up the indigenous stock by using males of improved exotic stock is also sound and suitable under the prevailing conditions.

32.1.22 We are informed that exotic breeds like *Large White* and *Middle White Yorkshire*, *Landrace*, *Tamworth*, *Saddleback* and *Hampshire* have been imported so far. As mentioned earlier in paragraph 32.1.12 the seven Regional Pig Breeding Stations are expected to take up selective breeding programme with the objective of acclimatization and further improvement of the imported exotic stock. Regional Stations would supply breeding stock to the breeding farms/units and these in turn would undertake the task of grading up the indigenous stock. It is disappointing to note that even after several years of establishment of Regional Pig Breeding Stations, no methodical selective breeding programme has been taken up. The result is that not only has there been no improvement in the stock but on the contrary in most of the Stations there has been a decline in various performance traits. It has been reported that several inadequacies like lack of farrowing pens and shortage of housing facilities, unsatisfactory feed compounding and watering arrangements, shortage of suitably trained personnel, and herd strength insufficient for carrying out any effective selection programme were the main reasons for the failure to achieve the objectives. A prerequisite for undertaking any selective breeding programme is the procurement of a good foundation stock. It is worthy of note that the Central Government

¹ Skirman, S. 1963. Crossbreeding experiments with swine. *Lantbrukshogskolans Annaler*. 31 39.

have recently laid down certain selection criteria for importation of pigs for breeding purposes. Furthermore, for achieving success in developing high production stock, maintenance of a minimum effective breeding population is necessary. The nucleus breeding population size should be 200 sows and 20 boars to avoid inbreeding and to have reasonable degree of selection intensity. As stated in paragraph 32.1.12 so far only 404 exotic pigs have been imported. Many more exotic pedigreed pigs need to be imported for implementing selective breeding programmes on scientific lines in the Regional Pig Breeding Stations. A comprehensive coordinated breeding programme should be drawn up for all the seven Regional Stations. Simultaneously, a well drawn out programme of production of commercial pigs should be taken up so that the genetic improvement of the herd as also supply of pigs to the bacon factories can be accomplished. Exotic bacon producing breeds like *Large* and *Middle White Yorkshire* and *Landrace* appear to have adapted well to the agroclimatic conditions of the country and are preferred by the farmers. In some parts of the eastern region of the country, however, people have a preference for black coloured pigs. So, a suitable breed like *Berkshire*, *Hamshire Saddleback* or *Poland Chine* should be the choice for these areas.

Artificial Insemination

32.1.23 Artificial insemination (AI) has been used for effecting pig development in some countries that produce high quality pigs. In our opinion, it would be advisable to give trials to this method of breeding in order to determine how it would pan out under Indian conditions. If found practicable it should be adopted in important pig breeding stations. As the equipment for AI in pigs is not manufactured at present in India, local manufacturers of AI kits should be encouraged to fabricate the kit by providing them with necessary samples and designs.

32.1.24 There is a strong need for adopting a coordinated breeding programme in all the Regional Pig Breeding Stations in order to exchange breeding stock and ideas and to discuss and evaluate the progress of the programme. For this purpose the officers-in-charge of the stations should meet say once a year. We recommend formation of a coordinating cell and the officer-in-charge of each breeding station may act as coordinator by turn for a period of one year.

All India Coordinated Research Project

32.1.25 The ICAR initiated an All India Coordinated Research

Project on Pigs during the Fourth Five Year Plan. The project, sanctioned in October, 1970 started functioning early in 1971. The major objective of the project is to develop suitable breed or breeds using imported stock. The centres where this project is in operation are the (a) Indian Veterinary Research Institute, Izatnagar, (b) Assam Agricultural University, Khanapara, (c) Andhra Pradesh Agricultural University, Tirupathi and (d) Jawaharlal Nehru Krishi Viswa Vidyalaya, Jabalpur. The coordination of the work of the project is done by the Centre. It is reported that the technical programme as was drawn up has not been followed in any of the centres. We have been informed that the performances of *Landrace* at Assam Agricultural University, Khanapara and Izatnagar and *Large White Yorkshire* at Tirupathi and Jabalpur procured from within the country, are being evaluated. The project is to continue in the Fifth Five Year Plan. The objective of such a project should be the evaluation of the performances of different breeds and breed combinations under different agroclimatic environments prevailing in the country so that the most suitable breeds for different locations could be selected. It has been recommended by a Study Group on Animal Genetic Resources (Pig Breeding) of FAO¹ that "performance be recorded on 50 sows with 3-4 litters of each variety and that these measurements should be made not on imported animals, but on acclimatized offsprings. Fattening performance should be recorded on 120 to 200 pigs of each sort, produced by 8-12 sires out of at least 20-30 sows". In view of the above observations, we recommend that if any useful results are to be achieved from the ICAR project, the present working programme should be suitably modified and herd strength enlarged. Adequate funds should be provided to create necessary infrastructure in all the participating centres without which it will not be possible to implement any meaningful technical programme and any attempt to develop suitable breed would be sheer wastage of money and manpower. We suggest that necessary arrangements should be made early to import superior germplasm resources for the foundation stock for this project.

Breeding Programme for Agricultural Universities

32.1.26 Where the better type of indigenous stock is available, the agricultural university of the area should take up breeding work on pure indigenous stock and should also investigate about the appropriate exotic breed to be used for the grading up of the indigenous stock. Investigations should be undertaken to determine differential response, if

¹ Report of the third ad hoc study group on animal genetic resources (pig breeding). 1971 Food and Agricultural Organization, Rome.

any, of improved, exotic, graded, and indigenous stock to climatic and nutritional factors and disease resistance.

SFDA/MFAL Projects

32.1.27 In the Interim Report on Poultry, Sheep and Pig Production through Small and Marginal Farmers and Agricultural Labourers for Supplementing their Income, we have recommended pig production programmes in 100 selected districts. The plan of operation recommended in these districts was as follows :

Twelve existing SFDA/MFAL districts are to be linked with the existing bacon factories ; another 12 existing SFDA/MFAL districts are to be linked with the bacon factories that are planned to be set up during the Fifth Five Year Plan; in 22 existing SFDA/MFAL districts where pork consumption is popular, pig farming should constitute a component of the project; the remaining 54 new districts not presently covered by SFDA/MFAL but offer good scope for piggery development should also be covered by SFDA/MFAL project with pig rearing incorporated in the programme. The recommendation is to cover 2,000 families per district. In the Interim Report we have recommended that initially three sows either crossbred or pure exotic breed, should be given to each family. Depending on performance, the number could be increased by two or more in subsequent years. We have been informed that the Central Government have decided to implement the scheme in 50 districts in the Fifth Five Year Plan and to cover 500 families per district. Thus, by the end of 1978-79, 25,000 families will be covered. We recommend that by 1985, at least 2,000 families in each of these 50 districts should be covered and wherever there is a larger market, the unit size should be increased. By 2000 AD, the entire 100 districts recommended in the Interim Report and 2,000 families in each district should be covered. The quality of pigs should be improved i.e., instead of first generation crossbred produced by crossing exotic boars with indigenous sows, either graded boar with higher exotic inheritance or crosses between exotic breeds should be used. The unit size should also be increased from three to five.

32.1.28 For successful implementation of crossbreeding programme, a large number of boars of exotic breed will be needed. Each State Department of Animal Husbandry should strengthen the infrastructure of their farms for meeting the demand of the breeding stock specially in the areas where the SFDA/MFAL programmes involving piggery development have been taken up.

Piggery Development in North Eastern States

32.1.29 Pig development has a special significance in the north

eastern hilly regions. Pork and pork products are popular in the north eastern States. Consumption of pork is high. We have dealt with this aspect in detail in Section 4 of our Interim Report on Some Important Aspects of Livestock Production in the north eastern States. We are very pleased to learn that the Central Government is taking up a very comprehensive piggery development programme for the north eastern States with the help of Danish International Development Agency. As has been envisaged under this programme, a regional pig breeding station of 200 sows capacity will be established at Shillong and there will be 7 sub-units for all other north eastern States and one sub-unit for Assam Agricultural University. Each of the sub-units will have 30 breedable sows. A pig slaughter house having capacity of handling 20 pigs a day will be attached to the Regional Pig Breeding Station. A pig slaughter house having the capacity of handling 10 pigs a day will be attached to each of the sub-units.

32.1.30 We are of the view that the Central Government have taken a right decision for intensifying pig production in the north eastern States. Intensification of pig production will be a timely action to bring about a balance between supply and demand for pork. The scheme should be implemented expeditiously.

Feeding

32.1.31 The major expense in commercial pig production is the feed cost and it accounts for 70 to 80 per cent of the total cost of pig production. The indigenous pigs, however, survive through scavenging and on kitchen wastes and farm byproducts. To change pig production from its present practice of subsistence operation to a commercial operation, supply of nutritionally balanced economical ration would be a matter of primary importance. Except in the feed mixing units attached to bacon factories, there is practically no compounded feed that is being manufactured for pigs at present.

32.1.32 A good pig ration contains 70 to 75 per cent grains, mainly yellow maize. The shortage of grains is at present very adversely affecting the livestock industry as a whole but more specially the pig and poultry farming. The pig farming can be made remunerative mainly by keeping feed cost low, rearing pigs with high feed conversion efficiency and by ensuring remunerative price for the products. Under the prevailing shortage of grains, attempts should be made to use more of agricultural and industrial byproducts in place of grains to the extent feasible in pig ration without adversely affecting performance. Cereal grains, rice polish or rice bran, oil cakes and fish meal constitute almost 95 per cent of a good pig ration in India at present.

All these ingredients are, of course, common for all classes of livestock feeding, specially for the monogastric ones. The availability of these ingredients for livestock feeding and associated problems have been dealt in greater detail in Chapter 34 on Livestock Feeding. Some salient points are being discussed in this Section which are of special importance for pig feeding.

32.1.33 Maize is the chief source of energy in pig ration. However, it can be replaced to the extent of 50 per cent by smaller millets. This has been done in some of the pig producing countries of the world. In a feeding experiment conducted at the IVRI, fifty per cent maize of a sixty per cent maize containing reference ration was replaced by wheat bran but no significant difference was observed in the rate of gain in body weight in growing pigs¹. In some other feeding trials carried out by the Kerala Agricultural University, tapioca meal has been used effectively as a source of energy. Research on utilisation of agro-industrial byproducts for pig feeding has not received adequate attention so far in the country. We recommend that intensive researches in pig ration should be initiated on a much larger scale than at present by the ICAR at IVRI and agricultural universities, for identifying low cost ingredients for replacement of grain in pig ration. Protein requirement in pig ration is mostly met by various oil cakes and fish meal. Oil extracted soyabean meal is extensively used in pig ration in several agriculturally developed countries. This would also be possible in the country if sufficient quantity of soyabean is grown and a suitable technology is developed for preparing oil extracted soyabean meal. However, emphasis has to be laid at present mainly on groundnut and other oil cakes. Scarcity of good quality fish meal is being felt for the past few years. In pig ration, fish meal needs to be added to the extent of 7 to 8 per cent if oil extracted soyabean meal is not used. Meat scraps can replace a major share of fish meal. This would be more economical than fish meal provided the carcass utilization centres are set up and fallen carcasses are fully used. This subject has been discussed in more detail in Chapter 36 on Meat Production and Animal Byproducts. 'Spent up' wash from breweries can serve as an effective replacement for protein feeds. We understand that large quantities of barley waste can be made available from the beer industry for animal feeding. The potential of these sources should be fully determined for exploitation as feeds for pigs.

32.1.34 Pig production and particularly bacon production have been most successful where the dairy industry is well developed. A good example of this is Denmark. The Danish *Landrace* is accepted

¹ Ranjhan, S. K., Gupta, B. S., Chabra, S. S. and Dhulopker, B. S. 1971. Effects of various levels of crude fibre and digestible energy on growth rate of Middlewhite Yorkshire pigs. *Ind. J. Anim. Sci.* 41(5) : 313.

as the best bacon producing breed in the world. Dried skim milk constitutes an important component of the ration for pigs in that country. As dairy industry in India is developing dairy byproducts are expected to be available in future for other purposes. These can effectively be used in pig ration if these are available at economic prices.

32.1.35 We have been informed that various nutritional requirements of different classes of pigs of different age groups, viz., sucklers, growers, adults, breeding boars, gilts and sows and market pigs for rearing under various climatic conditions in the country have not been adequately studied. The optimum protein energy ratio in the ration is likely to vary in different climatic conditions. We, therefore, recommend that research studies on the nutritional requirements of various classes of pigs should be undertaken without delay.

32.1.36 Inter and intrabreed differences exist in their efficiencies of feed conversion. There is also variation among pigs in the amount of lean meat produced per unit of feed consumption. As development of pigs with high efficiency in feed conversion through careful selective breeding is of great significance in pig production, we recommend initiation of such breeding programmes as soon as possible. Another fruitful area of research that should be developed relates to the effect of restricted feeding and of different feeding practices on meat production. Restriction of feeding can either be done by restricting the energy content of feed or by limiting the total quantity of feed intake or limiting the time of feeding. Various feeding practices may markedly influence carcass composition. Different breeds, strains or other genetic groups like sire family within a strain or a breed may behave differentially on different types of feeding practices and/or nutritional standards. This area of research, if developed properly, can effectively be exploited for reducing the cost of feeding and also for increasing the output of lean meat. Such studies should be the joint responsibility of pig nutritionists and geneticists. We recommend that the researches on the above lines should be initiated by the IVRI and agricultural universities for long range benefit of pig production in the country.

Health Cover

32.1.37 The importance of providing an effective health cover for the success of the intensive piggery development programmes has been stressed by us in paragraph 6.16 of the Interim Report on Poultry, Sheep and Pig Production through Small and Marginal Farmers and Agricultural Labourers for Supplementing their Income. We note with satisfaction that one of the most serious disease of pig, viz.,

swine fever is now under control. During 1961 to 1969 it was responsible for causing heavy mortality among pigs. Large scale vaccinations with crystal violet and live attenuated swine fever vaccine brought it under check and no authentic case of the disease was reported during 1972 and 1973. However, we have been informed that some suspected cases of swine fever were observed in Nagaland and Meghalaya during 1974. As such there should not be any relaxation of vigil over the disease. A systematic policy to keep swine fever fully under control with the ultimate objective of eradicating it has been outlined in Chapter 35 on Animal Health.

32.1.38 Foot and mouth disease (FMD) is another scourge, control of which needs urgent attention. The disease has assumed great importance with the launching of piggery development programmes involving importation of large number of exotic pigs, which are highly susceptible to FMD. We have been informed that in some of the severe outbreaks as high as 22 per cent mortality occurred in imported pigs. Shedding of hooves, ulceration of the epiglottis, vesicles on the scrotum, mammary glands and teats, abortions in pregnant sows and intra-uterine death of foetuses were observed. Unfortunately no vaccine which confers satisfactory grade of immunity against FMD in pigs is yet available. The IVRI should, therefore, intensify efforts to produce an efficacious and inexpensive vaccine at an early date as recommended in Chapter 35 on Animal Health.

32.1.39 Control of worm infestations should also receive high priority as worms affect the health of pigs very adversely. As recommended in paragraph 6.16 of the Interim Report on Poultry, Sheep and Pig Production, the extension veterinarians should regularly visit the pig farms for undertaking preventive measures and curative treatments.

Housing and Equipment

32.1.40 Unlike indigenous pigs, the raising of exotic or cross-bred pigs is possible only under proper housing and sanitary conditions. Improved pigs require well ventilated and well lighted pens fitted with watering arrangements and feed troughs. There is particularly a need of having separate farrowing pens for pig rearing on modern lines. Hardly any work has been done in India to fabricate cheap pig houses. We recommend that studies should be undertaken on designing and construction of suitable cheap houses for pig farming using locally available materials.

32.1.41 The probe used for measuring backfat thickness is a useful equipment and can easily be fabricated in the country by the surgical

instrument manufacturing companies. Steps should be taken to make them interested in manufacturing the equipment. A more sophisticated equipment, the sonoscope, is used for the estimation of backfat of pigs without any surgical operation or inflicting pain to the animal. Incentives to fabricate this equipment should be given to instrument manufacturers. We, therefore, recommend that the Government should permit importation of a few sonoscopes to serve as a model for fabricating the equipment in the country.

Credit, Co-operatives and Marketing

32.1.42 Credit facilities available at present from institutional sources for pig farming are inadequate and unsatisfactory. The traditional pig farmers are mostly at the mercy of local money-lenders. The findings of the survey conducted by the Progressive Agro-Industrial Consultants regarding the role of money-lender and its effect on primary producer is worth considering. The following is a quotation from the survey report :

"We found that the Mahajan (village money-lender) somewhere in Bihar purchased some piglets after weaning at Rs. 15—25 each and gave them to the traditional producers (usually Harijans) for rearing. When the piglet attains maturity after a year or so, it is sold at Rs. 130—150 each. The Mahajan then realises his initial outlay of Rs. 15—25 from the producer. The balance of Rs. 115—125 is not, however, allowed to be retained by the producer. The Mahajan claims 50 per cent of this also as his share. Thus by investing Rs. 15—25 on piglets, the Mahajan realises a profit of Rs. 57.50—62.50 which gives a net return of 260—380 per cent per annum. On the other hand, the traditional producer loses as much as 55 per cent of the sale price of pig, although he provides labour and bears all expenses upto the selling point.

In case the piglet dies, the Mahajan provides the Harijan with another one. After a year or so, when this piglet grows up and is sold out, the Mahajan claims from the sale price not only the price of the second piglet but also of the first piglet which had died earlier. The remaining amount is then shared equally between the Mahajan and the producer.

It is important to mention here that if banking facilities were available to the primary producer and he could obtain bank loan for the purchase of a piglet at the usual bank rate of interest, it would have been possible for him to realise

Rs. 114—123 as against Rs. 57.50—62.50 when the piglet is loaned by the village money-lender.

The village money-lender sometimes also provides the producer with a sow on condition that 50 per cent of the piglets born out of this sow would fall in his share. Assuming a purchase price of Rs. 180 per sow, a litter size of six and a sale price of Rs. 150 per adult pig, it would mean that the money-lender would realise Rs. 450 on an investment of Rs. 180 and thus realise an interest of 150 per cent. This shows the extent of loss to the primary producer due to lack of availability of institutional credit."

32.1.43 In the light of the above findings we recommend that necessary steps should be taken to make institutional credit facilities available to the pig farmers to save them from ruthless exploitation by village money-lenders. The best way to develop pig industry is to provide an incentive price to the primary producers by organising them on co-operative lines. Denmark provides a good example of success of co-operative movement in putting the pig industry on sound footing. As early as 1962, the Working Group of Dairy and Animal Husbandry Co-operatives set up by the Union Ministry of Agriculture, emphasised the formation of Primary Producers'-cum-Marketing Co-operatives of small pig producers. It is unfortunate that most of the recommendations of the working group are yet to be implemented. The formation of producers' co-operatives would eliminate the middlemen and ensure remunerative return to the pig producers. These co-operatives should be started in compact pig producing areas and should arrange loan with the help of Farmers' Service Societies as recommended in our Interim Report on Credit Services to Small and Marginal Farmers and Agricultural Labourers. The Co-operatives should arrange for supply of improved stock, distribution of balanced mixed feed at reasonable prices, provision of health cover, rendering technical assistance and help in the marketing of pigs. After gaining sufficient experience, they can take up organised slaughter of pigs and processing of pork products. As mentioned in our Interim Report on Poultry, Sheep and Pig Production, we agree with the recommendations of the Working Group that these co-operatives should receive substantial financial assistance from the Government towards share capital, working capital, development of infrastructure, managerial assistance and technical guidance. In the Interim Report, we have recommended formation of pig producers-cum-marketing co-operatives as primary societies in different parts of the districts, with groups of about 100 small pig breeders in compact areas. These primary societies should federate into a District Union. The District Union should help the

primary societies in collection, transport and marketing of pigs to large consuming centres like bacon factories and large slaughter houses. These District Unions should ultimately take over the administration of bacon factories.

32.1.44 Except for a very small fraction, pork produced in the country goes to the market as fresh pork. We recommend that the consumption of fresh pork is to be encouraged till such time chilled products can be supplied at a reasonable price.

32.1.45 At present there is hardly any effective programme for consumer education to dispel prejudices and wrong notions about consumption of pork and pork products. All the bacon factories should undertake a co-ordinated programme for taking up a programme on consumer education.

32.1.46 There is a general prejudice against eating of pork. Consumption of pork and pork products is at present confined to certain tribes and castes and sections of poorer class of people in urban and rural areas. In large metropolitan cities a small section of sophisticated population also consume these products. Except for Muslims, the prejudice against pork and pork products is not due to any religious sanctions but due to wrong notions, ignorance and perhaps mostly because of the existing scavenging types of pigs. Introduction of purebred exotic stock with improved methods of breeding, feeding and meat handling can go a long way in removing some of the prejudices. The strong preferences of tribal population for non-vegetarian diet suggest that extensive piggery development could ease the problem of acute shortage of meat to some extent.

32.1.47 To remove resistance against pig meat, sufficient promotional activities to popularise consumption of pork and pork products is essential. Some of the important steps that should be taken for this purpose are as follows :

- (i) Establishment of modern meat booths at different places and extensive as well as intensive publicity and propaganda regarding the value of high quality protein-rich pork and pork products ;
- (ii) banning of pig rearing in metropolitan areas ;
- (iii) encouragement to school and college canteens for selling pork products in the form of hamburgers, hot dogs, pork chops etc. at subsidised rates ;
- (iv) encouragement to the bacon factories to diversify the range of their products and make such articles as small-cut chops, keemas, pork chops etc. that can be used in place of mutton. This will reduce pressure on the demand for mutton and assist consumers in getting equivalent meat

- products at lower prices ;
- (v) encouragement to bacon factories to develop their own chain of retail shops with cold storage equipment for sale of fresh pork and pork products ;
 - (vi) initiation of measures by the urban consumer societies to popularise consumption of pork and pork products ;
 - (vii) active publicity by the Central/State Governments for consumption of pork and pork products through cinemas, pamphlets and leaflets etc. in regional languages ; and
 - (viii) introduction of applied nutrition programme in tribal and backward areas.

Private Sector Pork Processing Plants

32.1.48 Processed and packaged meat marketing on commercial scale is of recent origin in the country. Major portion of pork produced is marketed through traditional channels for consumption by the poorer section of the community. A small percentage of the product is marketed in urban areas as processed and packaged meat. Commercial meat products are mainly confined to pork, ham, bacon and sausages. Production of processed and packaged meat was about 3.5 tonnes per annum till 1960-61. There has been a phenomenal growth in their production since then. During 1968, production of 5,000 tonnes was recorded and it was about 10,000 tonnes in 1974. This increase in production of processed and packaged meat is due to the establishment of a number of bacon factories both in the public and private sectors. In paragraph 32.1.14 we have referred to eight bacon factories established in the public sector. In the private sector several bacon factories and processing plants have been established to produce processed or packaged meat on a commercial scale. Three of the private owned bacon factories have capacities of producing 10, 50 and 250 tonnes of processed and packaged pork products per annum.

32.1.49 Private pork industry makes no attempt to promote pork production by extending inputs and services to pig farmers. The low price paid on the basis of live weight is not conducive for the production of superior quality pigs. Consequently, indigenous pigs reared under traditional methods are purchased at low prices and used for processing. Many of these private establishments have arrangements for buying carcasses of clandestinely slaughtered pigs or from unauthorised slaughter houses as these give them a much greater margin of profit. Thus, the private pork industry by selling the substandard pork obtained from indigenous pigs has posed a problem to those

who obtain pork from exotic pigs maintained under farm conditions. To prevent the private bacon factories buying carcasses through unauthorised sources the Meat Food Products Order, 1973 should be implemented and rigidly enforced.

Quality Control

32.1.50 A standard of quality control of the processed pork and pork products should be laid down and should be strictly followed. As mentioned in the preceding paragraph, if the Meat Food Products Order is implemented properly and the quality of pork and pork products is ensured, it would help in boosting up the consumption of pork and pork products. It may also help in opening the possibilities of an export market. The Central Food Technology Research Institute has excellent facilities for research on processing and packaging of meat and meat products. We recommend that the Institute should extend research studies on processing and packaging of pork and pork products to evolve necessary techniques for manufacture of these products under Indian conditions to match the standards attained by countries with international reputation for production of superior quality pork and pork products. Action is also necessary to have standards formulated for these products for eligibility for 'Agmark' certificate.

Training at Different Levels

32.1.51 Pig production is relatively a new venture in the country. There is considerable need for dissemination of scientific knowledge on rearing, management, economics of farming, slaughtering of pigs and processing of pork. At present, there is no special training programme on pig production either at the national, regional or State level. If an aggressive pig production programme is to be supported with trained personnel it would be necessary to organise suitable training programme. We recommend organisation of the training programmes on a three-tier basis, namely, for the field staff concerned with extension work, for the stock assistants and pig farmers and for the butchers and processors. For the qualified technical staff it would be desirable to organise programmes periodically either at the national or at the regional level. It is suggested that one of the pig breeding station-cum-bacon factories should be developed into an Inservice Training Centre. The training of stock assistants and farmers can be organised at each station. The training for butchers and processors should be organised in the pig slaughter houses and processing plants themselves.

2 EQUINES

32.2.1 Among the various types of livestock reared in the country horses and ponies and mules and donkeys occupy a position of comparatively lesser importance and they form a very small part of the total livestock population. Out of 344 million total livestock enumerated in the 1966 livestock census, horses and ponies represented only 0.334 per cent, mules 0.0002 per cent and donkeys 0.306 per cent. Even so, in certain areas and for a large number of people these animals provide the means of livelihood either partly or wholly. In the past, equines, particularly the horse and the pony, had a position of much greater importance in India like many other countries in the world. Before the advent of mechanised warfare, action in battle fields was inconceivable without the horse. Consequently, all countries used to maintain a large cavalry force. Besides the glory that the horse had achieved in battle fields, it had contributed immensely in the past even in the pursuit of purely civilian occupations.

32.2.2 Prior to large scale adoption of mechanisation in farm operations, horses were extensively used in the UK, Europe, Australia, the USA and South America for tilling the soil and other agricultural work. In India, use of the horse for cultivation is virtually unknown and its use for other farm work, mainly transportation of agricultural produce and supplies has been on a limited scale.

32.2.3 Before the introduction of automobiles for transportation, horses and ponies were, so to say, the only means by which speedy transport of men and material could be arranged either by using them in saddle or by hitching them to carriages. Not very long ago, elegant, shining carriages drawn by a single or a team of spirited, beautiful steeds symbolised nobility and aristocracy in India and other part of the world. Horse drawn carriages for public transport was the common mode of conveyance in many towns and cities all over the world. In Calcutta, when tramway service was first introduced, carriages used to be drawn by horses. For transportation of goods at a comparatively slower pace than by horse drawn carriages, there are types of horses like hill ponies that make excellent pack animals.

32.2.4 Mules and donkeys do not possess the speed of movement as that of horses but have characteristics that make them very desirable pack animals for transportation of goods. Before mechanised warfare, road development and automobiles began ousting the equines from their position of importance, mules had made invaluable contributions in providing logistic support in many battle zones and in fulfilling the requirements of transportation of goods for meeting civilian needs. Before the closure of the country's border with China, thousands of

mules were used to carry mercantile goods between India, Tibet and Sinkiang. The quality of mules was excellent and large numbers were bought by the army. Mules are still used in fairly large numbers by military establishments and civilian population. The donkey has been traditionally the poorman's animal for hauling goods in comparatively small quantities over short distances.

32.2.5 The utility of horses and ponies, mules and donkeys is now declining rather rapidly all over the world. This will be evident from the fact that the world population of horses declined from an average of 79.7 million between 1947-48 and 1951-52 to about 66.2 million during the next decade.

32.2.6 Development of roads necessary for improved transportation, invariably attracts mechanised transportation and animals as a general rule cannot stand in competition with machines for work performance. Road development and use of mechanised transport are related to time, space and economic prosperity. India being a vast country with greatly differing terrains and because of financial limitations, road development and introductions of mechanised transportation in all the regions of the country are bound to take considerable time. Furthermore, even after development of roads and introduction of mechanised transportation there are possibilities of special situations arising in certain regions where the economics of haulage of goods and transportation of men and material may work in favour of use of equines.

32.2.7 At present, considerable number of people in the hilly regions and in some of the States, particularly in dry, central and northern regions of the country are depending on horses and ponies, mules and donkeys in various degrees as a part of their means of sustenance. There are not many people whose living depends solely on these animals. The donkey, in particular, is an important animal in the economy of landless labourers, small and marginal farmers and other poorer sections of the community both in rural and urban areas. There can, however, be no doubt that progressively the usefulness of the equines as pack animals and for transport of men and material will decline. But with increasing prosperity of the people the utility and usefulness of the horse can be expected to grow for another purpose, i.e., the use of the animal for games, sports, pleasure and pastimes. There is, therefore, a definite need for giving a special consideration to these equines for their utilisation to the best possible advantage to the owners under the prevailing conditions and the anticipated change of circumstances in the coming decades.

Trend in the Change in Population

32.2.8 The only source of information on population of horses and

ponies, mules and donkeys is the livestock census held quinquennially. Table 32.3 shows equine population between 1951 and 1966 along with percentages and the extent of their decrease or increase with respect to 1951.

TABLE 32.3
Equine Population between 1951 and 1966

	1951	1956	1961	1966
				(thousand)
horses, ponies, mules and donkeys.	2,824 (100.00)*	2,580 (91.4) (-8.6)	2,476 (89.6) (-12.3)	2,277 (80.6) (-19.4)
horses and ponies	1,514 (100.00)	1,484 (98.0) (-2.0)	1,327 (87.6) (-12.4)	1,148 (75.8) (-24.2)
donkeys	1,249 (100.00)	1,057 (84.6) (-15.4)	1,096 (87.8) (-12.2)	1,054 (84.4) (-15.6)
mules	61 (100.00)	39 (63.9) (-36.1)	53 (86.9) (-13.1)	75 (122.9) (+22.9)

*Figures in parentheses refer to percentages with respect to 1951.

Without other corroborating information it is difficult to judge, how dependable the equine population figures are. The trend of population observed for mules is unusual. During the 5 year period between 1951 and 1956, the mule population showed a 36.1 per cent decline but during the subsequent ten years there was a rise of 92.3 per cent over 1956. Under normal conditions an increase of this magnitude in population size solely due to increase in birth rate and decrease in the rate of mortality is unlikely. After the 1956 livestock census due to Chinese and Pakistani incursions, unusual conditions, however, prevailed in the country from time to time. There is a likelihood that mule breeding was greatly intensified during that period and there was importation of mules in fairly good numbers. Moreover, concentration of these animals in different regions due to logistic considerations may have resulted in more comprehensive and complete coverage during census. Small number of animals scattered over wide areas considerably increases the possibility of quite a number of animals being left out during livestock census. The census data available at present are not quite satisfactory and some of the figures on population of different species of equines in different years are such as to cause doubts about their reliability. Appendices 32.3 to 32.5 show variations in populations of horses and ponies, mules and donkeys respectively between 1961 and 1966 in different States. The magnitude and pattern of variation found in

the population of all the species in a number of States are such that no satisfactory explanation can be found for such erratic demographic changes. Appendix 32.6 shows the variation in the population of horses and ponies and donkeys in different districts of Andhra Pradesh during the same period. Here again, the contradictory trends observed in the population in different districts admit of no logical explanation and it is not possible to make any plausible interpretation or draw any valid conclusions from the data.

32.2.9 The broad conclusion that can be drawn from the census data with a reasonable degree of accuracy is that beginning from 1951, there has been a continuous decline in the equine population in the country and that the decrease in the population of horses and ponies has been more pronounced than that in other species of equines.

32.2.10 One of the basic requirements for effective planning for livestock development is dependable information on population size, its distribution in different locations as also classification of the stock not only specieswise, but also in other categories like sex and age. Information is also required on the utilisation and disposal of the stock. The unsatisfactory position relating to enumeration of equines during livestock census has been mentioned in paragraph 32.2.8. In the livestock census, horses and ponies are classified in a single group without any indication of the purpose for which the animals are used. Grouping the large horses used for sport or racing or pageantry and by the army or the police together with the small walking horse used in the hills for riding and transportation and with the small animals used in carriages and pack, is not helpful for planning. At present, only horses and ponies are being classified agewise as those under 3 years and those above. Mules and donkeys are enumerated without any classification by age or sex. So as to make the census data on equines more meaningful for the purpose of planning for development, urgent action is required. We recommend that the Union Ministry of Agriculture and Irrigation should immediately constitute a committee to advise how and on what points information should be collected and enumeration done at the time of livestock census. The Committee should comprise representatives from the Animal Husbandry Division of the Union Ministry of Agriculture and Irrigation, ICAR, one or two Directors of Animal Husbandry/Veterinary from the States where equines constitute an important livestock, and one or two equine experts well conversant with equine breeding and management. Other actions, besides what should be taken by the census organisation, are required if realistic and effective planning is to be made for equine development. In Chapter 31 on Poultry we have suggested several steps that should be taken for getting more dependable statistics on different aspects of poultry production. Action

on similar lines should be taken in the interest of development of equines.

32.2.11 We would like to emphasise that realistic and effective planning for equine development is more difficult than for other livestock. Smallness of the size of population, widely scattered distribution of the stock with absence of concentration within a limited area, absence of breed or type descriptions, paucity of good specimens, non-existence of easily measurable, commonly accepted standards for assessment of the quality of the stock, poor financial resources of vast majority of stock owners, total absence of organisation except for a very small section of horse owners are problems which render the making of efficient planning extremely difficult. Moreover, in planning for equine development this has to be kept constantly in view that with time, progressive decline in the utility and use of equines is inevitable except for the horse for which there is likely to be an increasing demand for superior quality animals for games and sports. Planning for equine development has, therefore, to be phased in a manner that should fit in with the probable changing trends.

Types and Breeds

32.2.12 Horses—The horses in India can be placed broadly in two classes, the slow moving pack ponies and the fast running saddle horses used for riding or for drawing carriages. Slow moving horses predominate in the hills and are used extensively as pack animals; they are used also in some areas in the plains particularly by tribal people. The fast running horses are used by the army, for racing, riding, sports and for transportation of men and materials in wheeled carriages or otherwise both in rural and urban areas.

32.2.13 There are small groups of animals in the two classes that conform to a definite type constituting what can be considered as indigenous breeds of horses. The important ones of such types or breeds are the *Marwari*, *Kathiawari*, *Manipuri* and the *Bhutia*. Evolution of *Marwari* and *Kathiawari* has a rather recent history. Rajasthan and Kathiawar, homes of the *Marwari* and *Kathiawari* breeds, are both rather thinly populated areas and the need for long distance transport in the past resulted in the development of a hardy, strong and large-sized horse in the area. Existence of the princely States and the fighting among the princes and zamindars, further accentuated the need for fine horses and led to selection for the qualities that are now possessed by these breeds. In addition to their utility for quick transport over long distances, size and beauty were greatly prized, as a beautiful strong horse in the yard of a nobleman's house was a symbol of his greatness and refined taste. Selection was,

therefore, both for utility and beauty. *Marwari* and *Kathiawari* are considered as two distinct types or breeds though they have several characteristics in common.

32.2.14 *Bhutia* ponies are slow moving horses found in the hilly and submontane tracts of the Himalayan ranges. The animals of this breed possess a compact body, short thick neck, straight shoulders, well developed chest, strong back and round muscular quarters. The legs are short and strong with thick shin bones. The body and the legs are covered with thick coarse hair which form prominent tufts at the back of the fetlock joints. The tail is long and the mane well developed. *Bhutia* ponies have the reputation of having the capacity of going without food for short periods of time and of living on comparatively coarse feeds. They can walk long distances in the hills and are very surefooted. While the trade between India and Tibet was open, a number of good specimens of the breed could be obtained from Tibet to maintain the breed characteristics. Buddhist monasteries in these regions took keen interest in animal husbandry and contributed considerably towards the development of the horse in the past. Breeding stock is no longer available from Tibet. The monasteries are not taking interest in development of horses and the quality of the *Bhutia* breed is rapidly deteriorating.

32.2.15 The *Manipuri* breed of horses has been bred over centuries in the erstwhile Manipur State. These horses have the combined qualities of the breeds of horses of the hills and the plain. The animals of this breed, possess both good speed for use in the plains, and surefootedness required for work in the hills. They do not have a long coat of hair as possessed by animals of the *Bhutia* type and their shin bones are not so thick. The breed is reputed for its intelligence and is used for polo, racing and as pack animals.

32.2.16 Exotic breeds of horses introduced in India include the *Arab*, *English Thoroughbred*, *Waler*, *Connemara* and the *Polish*. A few horses of the draft breeds were also imported in the past. The *Arab* was the first to be introduced in the remote past and it is believed to have contributed substantially to the evolution of the *Marwari*, *Kathiawari* and the *Manipuri* breeds. Some of these exotic breeds have been utilised for developing race horses and army horses and others for grading up the local breeds on a very limited scale. Barring the *Arab* other exotic breeds have made little impact on the quality of the indigenous breeds in general except to a small extent in Punjab and Gujarat where stallion stands were maintained over a long periods for equine development.

32.2.17 Of the indigenous breeds of horses, only a few good

specimens can be found at present in the home tracts of the breeds. There is a belief that all the indigenous breeds are rapidly deteriorating in quality, as good specimens in each of the breeds have become scarce and there is no organised systematic breeding of indigenous horses at present. Unless effective steps are taken immediately to stem the decline and change the trend, the eventuality of the breeds losing their identity, in not very distant future, cannot be ruled out.

32.2.18 Mules—Mules have their use both in military establishments and in civilian occupations. Required by the army they are bred at the military farms. Two distinct types, namely, the Mountain Artillery (MA) and the General Service (GS) are bred there. The MA type mules are heavy, big sized and powerful animals required for carrying heavy artillery loads. The GS type mules are of lighter built and are used for general purpose transportation work. For breeding mules the military farms used imported donkey stallions.

32.2.19 In addition to the production of mules at the military farms, the army authorities and to a limited extent the civil Animal Husbandry Departments used to maintain donkey studs in selected areas for obtaining supply of mules. It is estimated that the total production of mules by these means never exceeded 200 to 300 per year. The production has at present gone down to less than 100 animals per year. The mules for civilian use are a mixed lot greatly differing in size and body conformation. Some of the animals are as good as those used by the military establishments but the majority are of poor quality.

32.2.20 Donkeys—Two types of donkeys are commonly found in India. The smaller size donkeys are dark grey in colour and predominate in number. The larger size donkeys are light grey to almost white in colour. They are distributed mostly in the Kutch area. Considerable variation in size and features are found among the animals in both the types. Good quality donkey stallions of exotic breeds are maintained in military equine farms.

32.2.21 Before Independence, donkey stallions were stationed at veterinary hospitals and at other depots of production of mules but no systematic breeding of donkeys was made except to a very limited extent in Punjab and Haryana for improvement of the stock. A herd of donkeys were imported from Germany and kept at Hissar. Some donkey stallions from this herd were maintained at stallion depots for production of mules and for improvement of local donkeys. In addition to the domesticated donkeys, wild donkeys are found in the Rann of Kutch and in Ladakh. These wild donkeys generally do not interbreed with the domesticated stock and have made no impression on their characteristics. The wild donkeys are reported to be a dying race.

Present Utility and future Prospects

32.2.22 Horses—Even a few decades ago, horse drawn carriages were the principal mode of transportation in towns and cities for movement of men and material in the plains. The position has now completely changed and in big towns and cities horse carriages have now become scarce. The use of horses in the plains for drawing carriages is declining very rapidly.

32.2.23 The high cost of carriage, horse, harness and maintenance of the animal and equipment are the other factors that have virtually sealed the fate of the use of horse drawn carriages. Their use is now limited mostly to the plains and from all indications it appears that in the very near future the utility of such carriages will remain confined to occasional use for ceremonial purposes and pastimes and for hauling goods in locations where other means of transport are not suitable. There are vast territories in the hills and in the foothills and some regions in the plains with poor road development where horses are still the most valuable pack animals for transportation of goods and to some extent for riding. There cannot, however, be any doubt that the areas of operation for pack horses will gradually grow smaller with the passage of time.

32.2.24 Majority of the people engaged in the transportation of men and material with pack ponies are poor. With many of them it is a part-time occupation and the earning made is meagre. Consequently, both the owner and his pony are almost perpetually in a state of impoverishment. While discussing "development programmes" we have indicated in paragraph 32.2.45 the line of action that should be taken to better the economic lot of these people.

32.2.25 A small number of horses of superior quality are used for watch and reconnaissance, patrol duty and security purposes by the army, border security force and the police. Superior quality horses are also utilised for racing, hunting, polo, riding, ceremonial purposes and pastimes, circus and mule production. A few horses are also required by the Pharmaceutical concerns for production of sera. The future of the horse for meeting these requirements is not bleak. The army, border security force and the police will decrease the use of horses with time but no sharp decline in demand is likely in the near future. The curtailment in the use of the horse that has already been made effective has brought down the strength of the horse maintained by these organisations almost to the point of a standby position. The utility of the horse for other purposes like sports and pastimes, ceremonies and production of sera instead of declining would, in all possibility, become greater with the passage of time and increasing prosperity of the people.

32.2.26 Mules—Mules, like pack ponies in the hills, have the greatest use as pack animals in different mountainous terrains for transportation of men and material. They get a preference over hill ponies because of their greater strength and sturdiness and surefootedness. In the plains, mule drawn carriages are used for transport of goods in moderately big quantities over short distances in towns and cities with good roads. It is reported that in Haryana and Punjab and in neighbouring States, there is an increasing demand in towns and cities for mule carriages for transportation of goods. We have been informed that for haulage of goods over short distances in moderately large quantities this mode of transportation has proved more economical than transportation by trucks and 'tempo's'.

32.2.27 Donkeys—Donkeys are used mostly for transportation of small loads over short distances and they are quite popular for this kind of work in the desert regions and in Ladakh. In urban areas they are used in good numbers for transportation of various kinds of materials. Donkeys are owned mostly by the poorer sections of the community who maintain the animals practically at no cost. Except at the time the donkeys are put to heavy work, the animals are generally given very little or no feeds and are left to sustain themselves by gathering whatever they can by stray grazing.

Equine Development in the Past and Present

32.2.28 During the days the horse had a prominent role in battles and warfare, keen interest was taken in their development. Large cavalry forces with excellent quality animals were maintained by many rulers. That excellent quality horses were being bred in the country, before the advent of the British has been mentioned in his book "The Arabian Horse" by Maj. Gen. Tweedie who served in India from the middle till towards the end of the nineteenth century. A few lines from the book are quoted below : "A century ago Hindustan yielded horses second to none in stamina" and also "we have often perceived among Rajputs and Mahrattas the same anxiety as distinguished the Arabas to keep pure the blood of a breed of horses. The mares (in Marwar, Rajputana) which they breed and of which they are most tenacious, display the clean muscle, leaned head, thin nostrils and large dark eye of Nejd. The breed owed nothing to crossing, but on the contrary, had been handed down unaltered in this pure blooded Rajput families through centuries of warfare". It is unfortunate that following the establishment of British rule the quality of indigenous breeds of horses declined badly but there are still some remnants left of the excellent quality animals of indigenous breeds. The excellent qualities that the indigenous breeds of horses possessed

in the past can be salvaged if concerted efforts on a big enough scale are made without any further delay.

32.2.29 Modern horse breeding was introduced in India in 1795 in the days of the East India Company. During that year, the Ganjam Stud was established with 25 Arab stallions and 500 mares. With the transfer of power to the British monarch by the East India Company the stud was taken over by the British Government. Eleven more studs were started between 1795 and 1843 and a Stud Department was established. This department was abolished in 1876 and in its place the Army Remount and Horse Breeding Departments were created.

32.2.30 The policy of the newly created Horse Breeding Department was to establish a native breed of horses through Government supplying stallions of the classes most suitable for improving the native breeds. Selected mares were branded to prove their right to free service by Government stallions and to prevent their purchase by cavalry or police horse buyers. A system of prize giving at the fairs and shows with some slight advantages to the produce of branded mares was instituted. All young stock fit for army service was bought by Government at 18 months of age and reared in Remount Depots before issue to units.

32.2.31 In addition to these, pony stallions were provided in suitable districts under the control of District Committees, to cover small and unbranded mares. Grave objections to this 'Diffused System' of breeding were voiced in knowledgeable quarters. In order to review the whole question of horse and mule breeding in India, the Government appointed a Commission 1900-01. The Commission made recommendations for the reorganisation of the whole system with a view to establishing a breed of Indian horses. This was to be achieved by (a) the unbound system and (b) the bound system. The unbound system—in reality was similar to the 'Diffused System' except that it was confined to favourable districts where there was natural advantage of climate and the soil and the people were interested in the breeding of horses. The bound system or the controlled system of breeding—envisioned issue of service condition grants of land in canal colonies in the Punjab. The condition was the provision of brood mares for breeding horses and mules and the Government lien on the youngstock up to 18 months of age. Animals rejected as unsuitable were at the absolute disposal of their owners. The unit of grant was 2 squares of land per brood mare approved by Government. The services of Government stallions were provided free of charge but all coverings were strictly regulated by the Government officers. The grantees were confined to members of those professions with hereditary taste for, or practical experience of, horses and mules. The scheme under competent

administration and arrangement was expected to put the country and the Government in possession of an extensive and valuable remount reserve. As a result, a breed of horse was evolved that is known as *Country Bred* or *Indian Bred*. It is a type of horse rather than breed.

32.2.32 Another most important point the Commission brought out was the recognition of the fact that in certain States of India there existed breeds of horses which were pure, which the local breeders strived to maintain pure and were, in the judgement of the Commission, well worth preserving in their purity. They particularly referred to *Kathiawari* and *Marwari* breeds. The Commission recommended that the Indian Government should purchase the most suitable stallions of these breeds and encourage the people of Kathiawar and Marwar to breed these horses both for army and civilian requirements.

32.2.33 Consequently, a stud farm to breed pure *Kathiawari* and *Marwari* horses was established at Ahmednagar in 1903. This was later closed in 1930 and people were enabled by grants and leases of land to breed horses but results were not quite satisfactory as the grant of land etc. was not adequate encouragement. Moreover, the continuing import of foreign horses was a great disincentive. Even the Indian States under the protection of the paramount power were largely dependent for horses on external sources of supply. A few States like Morvi, Junagadh, Mysore and Gwalior, bred horses on a very small scale.

32.2.34 Whatever little breeding success, however, was achieved through bound and unbound systems came to an abrupt end after the Partition of the country as all breeding establishments located in West Punjab went to Pakistan. Beside these developmental activities of the military organisation in British India, the Indian principalities, notably those of Rajasthan and Saurashtra established stud farms. They were mostly treated as closed herds and consequently did not materially contribute towards improving the quality of the local breeds of horses.

32.2.35 After Independence, attempts were made by the army to resuscitate horse breeding in India on the unbound system. But even the meagre requirement of 200 youngstock annually could not be met. This was mainly due to non-availability of brood mares suitable for breeding. Importation had to be resorted to and from 1949 to 1954 approximately Rs. 7 crores were spent in foreign exchange on importing horses, mules and donkeys. In 1960 army studs were established at Babugarh and Saharanpur and later at Hissar and Hampur. As a result of this policy, the army is now almost self-sufficient in regard to its requirement of horses, mules and donkeys. The farm at Babugarh has a herd of imported donkeys for breeding jack stallions and for production of mules. The equine breeding centres of the army have excellent facilities for the breeding of horses and donkeys and mules.

32.2.36 The only civilian horse breeding worth the name, after the Partition of the country was taken up by race horse breeders. But they restricted their breeding to the *English Thoroughbred* race horse only. It is alleged that they usually imported, through fair means or foul, mares in foal from England. The foals dropped in India changed nationality. These were sold as Indian yearlings at fabulously high prices. At Bombay Turf recently a filly fetched Rs. 2.5 lakh. The high price level is being kept up by their greater demand than supply. The race horse breeders produced only 150—200 horses which is barely half of the numbers to meet the annual wastage of the turf clubs. These breeders imported *Thoroughbred* stallions also. But the fantastically high stud fees, for example, Rs. 55,000 per covering by Rock of Gibraltar, is utterly out of reach of a peasant breeder. These breeders made no contribution towards national horse breeding and the peasant breeder could neither benefit from their know-how nor get the services of stallions for improving his stock because of fantastically high covering fees.

32.2.37 The Police Departments also carry out small scale breeding operations at their horse lines where the animals are kept for police duty and ceremonial purposes. Mention may be made of the horse lines at Madras, Bhopal and Ahmedabad where a number of foals have been born to mares mated to outstanding stallions. Such breeding operations by the police departments are of a casual nature and there are no specific plans for breeding horses to meet their own requirements. The Defence Department constitutes the principal source of supply of better quality horses for the Police departments, Border Security Force and riding clubs, and for ceremonial purposes at Rashtrapati Bhavan and other occasions.

32.2.38 The support of the Central Government extended through the then Ministry of Food and Agriculture and the Indian Council of Agricultural Research for horse development remained confined to providing health cover to the animals. Important studies on diseases of horses have been conducted under the schemes for disease investigation in some States and the Indian Veterinary Research Institute. In most of the States no scheme was undertaken on horse breeding for improvement of indigenous stock perhaps mainly because very little information was available on the requirements of the horse breeding industry. Moreover, the need for developing other species of livestock was so pressing that the development of horses, mules and donkeys did not receive priority in allocation of funds which had great limitations. The activities in most of the States were, therefore, restricted to provision of health cover.

32.2.39 After reorganisation of the States, the reorganised States

of Maharashtra, Karnataka and Gujarat took over the stud farms owned by the former rulers of the princely States that got merged with the newly formed States. The stud farm in Hingoli in Maharashtra has since been closed down and converted into a cattlebreeding farm. The stud farm at Kunigal in Karnataka has now been leased to the South India Turf Club. This farm is used almost exclusively for breeding race horses. The horse breeding farm at Junagadh in Gujarat is continuing to operate. The farm has, however, a strength of about 20 breeding mares and no definite breeding plan is being pursued for the attainment of a well-defined objective. The horses maintained at the farm belong to what is considered as *Kathiawar* breed. In the absence of an authoritative definition of breed characteristics based on objective measurable standards, selection of animal becomes arbitrary and subjective. The farm issues a small number of stallions every year for breeding purposes. Most of these stallions are auctioned or sold to private breeders who may or may not use the animals for further breeding. The Gujarat Government purchases *Kathiawari* stallions from the market and places them at the few stud centres that are still functioning in the State. A fee of Rs. 25 is charged for each mare bred at these stud centres. Each stallion covers 50 to 60 mares in a year but no records are maintained of the foals born. It is not surprising that these horse breeding activities have failed to make any impact on the indigenous breeds of horses in improving their quality.

32.2.40 Besides the stud farms of erstwhile princely States that were taken over by State Governments, the Government of Himachal Pradesh had undertaken development of horse breeds during the first three Plan periods. In addition to establishment of a number of stud centres, a small nucleus herd of imported *Connemera* horses was established for this purpose in the State. Efforts were made to grade up the local horses with the introduction of *Connemera* inheritance by stallions stationed at veterinary hospitals. During the Third Plan the progress of the breeding activities was reviewed and it was concluded that the *Connemera* breed was not quite suitable for the hilly areas. A decision was taken that the limited resources should be reserved for the development of other types of livestock. The stud centres and the *Connemera* horse farms have, therefore, been wound up.

32.2.41 During the Third Plan period the Indian Council of Agricultural Research approved of a scheme for the establishment of a horse breeding farm in North India but the scheme was later abandoned.

Development Programmes

32.2.42 Pack animals—Lack of organisation is one of the major

obstacles in the way of equine development. Except for the Defence establishments and the horse racing business there is practically no organisation engaged in activities concerned with development of equines. Though there are many difficulties to be confronted there is an urgent necessity for development of indigenous stock of equines, particularly for rendering assistance to large groups of people who are financially weak and depend on these animals for livelihood. Considering the prevailing situation, we are of the opinion that development of indigenous equines can only be possible through well coordinated and planned action at different levels.

32.2.43 In the past, the half-hearted, isolated and nominal efforts that were made for equine development in some of the States where these animals were of some importance, were ineffectual and wasteful. In view of this, we recommend that a detailed critical study should be made about the needs and requirements of the people engaged in the trade based on equines for planning equine development. Separate socio-economic studies are required on the trade of transportation of material and men by pack ponies and mules in the hilly regions; by donkeys, mules and horses in the plains; and by mule-carts in urban areas in the plains. The aim of these studies should be to gather detailed information on various aspects of the trade so that a clearer idea could be had on the types of animals that would be most suitable for particular areas and the nature of services and inputs and assistance that may be required to make the trades sufficiently remunerative.

32.2.44 Without such a survey it would be wrong to rush to the conclusion that supply of superior quality equines to these people would solve their problems and improve their financial status. In certain areas, supply of superior stock may be more of a disadvantage to the trader than being of assistance to him. He may not have the resources to maintain a better animal or derive a proportionate financial gain by spending more on superior quality animals. There are many areas where the animals are hired not on the basis of its quality of drawing heavier load or doing a faster work but on the basis of just an animal unit. Naturally, the owners of animals in such a situation are not interested in better quality animals but in keeping poor stock with as little maintenance cost as possible. In places where the hire of the animal is based on the load to be transported or the speed of movement or appearance of the animal, a better quality animal would be a greater asset. It should be realised that mere development of the equine stock of the traders would not solve their problems.

32.2.45 Along with the steps that may be taken for stock development, several other steps are required to vitalize the trade of equine transportation to benefit the traders. We are of the view that equine

development work relating to the trade of transportation of material and men should be developed on lines somewhat similar to the Intensive Cattle Development Project or the Intensive Poultry Development Project in carefully selected areas. As in the case of cattle and poultry development projects, equine development project should have the necessary inputs and services made available in a package deal for attainment of success. Equine development projects would not have any 'products' for marketing as in the case of poultry or cattle development projects. But with proper organisation of the persons engaged in the trade of transportation, the 'product' of work by the animals could be so arranged as to make the transport trade profitable. For preparing the blueprint of equine development projects and for selecting the areas where such projects should be undertaken, socio-economic studies as mentioned earlier in the paragraph are essential. We recommend that the Indian Council of Agricultural Research should immediately sponsor such research studies to be undertaken in agricultural universities of selected States. For such socio-economic studies, an equine expert should be included in the teams. The information to be gathered and the method of analysis to be adopted should be very carefully planned before the study is undertaken. On the basis of these studies suitable development programmes should be formulated for different selected locations. In this connection a mention may be made of a cooperative of donkey owners at Allahabad that has made impressive progress in bettering the status of its members.

32.2.46 Equine transportation is at present and will in future remain useful generally in tracts with poor road development. Since such areas lie mostly in the lesser developed States, projects for equine development aiming at providing assistance to the weaker section of people engaged in equine transportation trade may have to be supported fully or largely by the Central Government by way of finance and technical guidance. We are of the opinion that the Central Government should accept this liability as its contribution towards social justice and for removing regional imbalances.

32.2.47 Transportation by horse drawn carriages has now reached a stage where it is not possible or even necessary to try to vitalise this trade with a special effort. The residual need of ponies required for carriages can be met from the existing production of indigenous stock. If the need for horses for carriage continues in future as at present that could be easily met from the proposed horse breeding programmes mentioned in paragraph 32.2.65.

32.2.48 Equines for Defence establishment—It has been mentioned earlier in paragraph 32.2.35 that the Defence Department has now attained near self-sufficiency in the production of horses, mules and

donkeys. The military horse breeding farms are at present the principal source of supply of superior quality horses for meeting the requirements of para-military establishments and various other civilian activities. In the subsequent paragraph 32.2.64 while discussing the development of indigenous breeds of horses we have pointed out that with programmes of development of indigenous horse breeds and proper organisation, it should be possible to meet such para-military and civilian requirements through establishment in the civilian sector. The army establishment is in a position to extend very valuable assistance to the civilian sector in the establishment of equine breeding organisation by way of supply of equine breeding stock particularly of donkeys as also advice and technical guidance. The Directorate of Remount and Veterinary Services possess the best expertise in equine breeding in the country. Such collaborative work was done in the past and we believe that there should not be any difficulty to revive collaborative work between the civil and military establishments.

Horses for Sports, Games and Pageantry

32.2.49 Of the equestrian sports, the one most flourishing is that of horse racing. There are at present five main race clubs organising and controlling the major racing events in India. In addition to these, there are four gymkhana race clubs. Beside these, there are five race clubs in the hills such as those at Darjeeling and Ooty. A total of over two thousand horses take part in some 1,500 races each year. Gross turnover of Western India Turf Club, Bombay alone is Rs. 18.5 crores. It is believed that there is a leakage of almost the same amount through illegal betting, thereby depriving the Turf Clubs and the State Governments of many crores of rupees annually. The investments made in racing is estimated over one hundred crores of rupees, and the income to the Central and State Governments through taxes exceeds eight crores a year. The income to the Local Boards and Municipalities is of the order of two crores a year. If the leakages could be sealed, the income to the Central and State Governments and Local Boards and Municipalities would be increased a great deal.

32.2.50 The principal objective of the Turf Clubs which control racing in other countries, including the Commonwealth countries, has been to promote national horse breeding. But nothing of that kind has happened in India. In many countries like Sweden and France all betting in horse racing is controlled by the Government and Bookies have been abolished. There is thus no chance of illegal betting and huge profits accrue to the Government. Large sums from these profits are ploughed back to promote national equine development.

programmes. We are of the view that it would be in national interest for the Government to take full control of horse racing in the country. Such a step can put the sport of horse racing on a clean and healthy footing and it would be possible to utilise the sport, as is done in several countries, for promoting equine wealth for the benefit of the nation. A portion of the increase in revenue that the Government would collect should be adequate to undertake the various equine development and other related activities that we are recommending in the Report.

32.2.51 Race horses are bred in India and these are owned by about 300 registered breeders and owners. The race horse breeding industry is, however, heavily dependent on imported stock. The number of race horses to be imported annually has been variously estimated between 200 and 500. Allocation of adequate foreign exchange for such a large number of animals is not feasible. The Central Government has, therefore, restricted import to as many animals as can be obtained with an annual release of foreign exchange worth three lakhs of rupees. In addition, breeding stock is allowed to be imported if no free foreign exchange is required by the importer. The allotment of foreign exchange is made on the recommendation of a Committee working under the chairmanship of the Chief Controller of Imports.

32.2.52 Race horse breeders have made a representation that the foreign exchange allotment for import of race horses for breeding is very inadequate and that improvement is needed in the system of issue of permits against this allotment. At the meetings arranged by the Union Ministry of Agriculture and Irrigation with the race horse breeders and other racing interests, these subjects have been discussed from time to time in a wider perspective of the relationship of horse racing to the development of horse breeds and of developing racing as a healthy sport. Recommendations made at these meetings have not been followed up faithfully as there are no voluntary controls observed by the breeders and the turf clubs and there is no existing machinery to enforce the recommendations.

32.2.53 A fresh review of the entire field of horse racing and race horse breeding industry in India is necessary. We, therefore, recommend that the Union Ministry of Agriculture and Irrigation should without delay convene a meeting of all interests and specialists concerned with the import, breeding, racing and training of horses in India. The impact of taxes and other charges levied on the breeders of horses and turf clubs should also be reviewed by this Committee so that the taxation policy can be rationalised. The ways by which the horse race industry can contribute towards the promotion of

equine industry in general within the country should also be considered at this meeting.

32.2.54 For the present, blood stock breeding of race horses may be left in private hands. But urgent action is called for for more effective control on various alleged undesirable practices like, breeding of horses in insufficient numbers, charging of inordinately high stud fees, importation of horses in irregular manner etc. mentioned earlier in paragraph 32.2.36.

32.2.55 To exercise control on racing and all organised equine breeding including that of race horses and for promotion of national equine development programmes for improving the equine wealth of the country, we recommend that the Union Ministry of Agriculture and Irrigation should establish a high powered Equine Development Board (EDB) as early as possible.

32.2.56 As an immediate measure to control breeding of race horses, steps should be taken to register all private studs with the Equine Development Board. No new private race horse breeding stud should be allowed without the sanction of the EDB. Before granting permission, the EDB should ensure by inspection that necessary land for housing and for growing fodder, and stables conforming to normal standard and proper knowhow of horse management is available. The stud farm should be inspected every year to ensure that only licensed stallions are used and that the stables etc. conform to reasonable standards of sanitation and other requirements. It is also necessary to take steps so that race horse breeding industry contributes materially to the improvement of the equine stock of the country. Though controls are necessary and desirable, every precaution should be taken so that control and restrictions do not result in lowering the standard and quality of the race horses.

32.2.57 At present matters relating to equines are not the exclusive responsibility of any specialist in the Animal Husbandry Division of the Ministry of Agriculture and Irrigation. Such an arrangement is not conducive to equine development in the country. The proposed EDB should have representatives of the Union Ministry of Agriculture and Irrigation, the ICAR, Directorate of Remount and Veterinary Services, National Horse Breeding Society, Equestrian Federation of India, Chief Controller of Imports and an eminent non-government person knowledgeable and interested in equines. The EDB should be responsible for making an assessment of the fresh blood of exotic stock required to be imported for different horse breeding activities in the country. For purchase and importation of stock from abroad, the Union Ministry of Agriculture and Irrigation should constitute Purchasing Missions from time to time as necessary on advice from EDB.

32.2.58 High quality race horses are very expensive animals. It is, therefore, necessary for the breeders in India to take steps to maximise the utilization of imported and other high quality horses. For this purpose the breeding charges levied by the studs should be reviewed and, if found necessary, the charges should be revised.

32.2.59 The wastage of race horses due to leg injuries and other causes is considerable. The rate of reproduction is low. Improvement in rate of reproduction should be possible with better veterinary care and management of the mares during pregnancy and at foaling. A drain on horses due to defects in legs can be reduced by having better qualified trainers and by improving the racing tracks.

32.2.60 Possibly because of the traditional love of the British for the horse, equestrian sports like polo and riding were quite popular earlier. There has lately been a marked decline in the patronage and popularity of such sports. Equestrian sports are excellent activities for body building, development of courage and daring, cultivation of sense of discipline, and comradeship or team spirit and love of animals. Promotion of equestrian sports can contribute equally or in a greater measure in building national character and health as many other outdoor sports and games like swimming, hockey etc. A number of foreign countries have mounted teams for participation in olympic equestrian games.

32.2.61 Various promotional activities are undertaken by the Central and State Governments and private organisations for different games and sports. We recommend that similar activities may be undertaken for the promotion of equestrian sports. The proposed EDB, the Turf and Gymkhana Clubs, the army and police organisations, Animal Husbandry Departments of the Central and State Governments as also the Department of Sports existing in some of the States can do a great deal to cultivate interest in equestrian games and sports without incurring a great deal of expenditure. Horse show that is organised by the Army at Delhi can easily be arranged in other cities. Riding displays or riding competitions may be arranged by the police or the army in different cities from time to time. Occasional organisations of various types of riding competitions and games requiring use of the horse by the Departments of Sports in the States where those exist or by other bodies interested in sports should not be difficult. Inclusion of equestrian games in livestock shows would greatly add to the interest of the shows. There were some practices followed in the past that promoted interest in equestrian sports. In many veterinary colleges horse riding was encouraged and trainers were retained for giving lessons in equestration. In some colleges riding was compulsory. Horse shoeing constituted a compulsory subject. In police training, riding was a

compulsory requirement. We believe that those were very desirable practices and recommend that consideration may be given for revival of those practices.

Preservation and Development of Indigenous Breeds of Horses

32.2.62 It has been indicated earlier in paragraph 32.2.17 that there is a danger of existing small groups of indigenous horses having desirable characteristics losing their identity unless urgent steps are taken to preserve and develop breeds.

32.2.63 Preservation and development of livestock breed cannot be advocated merely on sentimental reasons. We are recommending preservation and development of the indigenous breeds of horses on utilitarian consideration. In paragraph 32.2.14 we have mentioned that *Bhutia* ponies are found in the large hilly and submontane tracks of the Himalayan ranges. In these areas, equine transportation is of considerable importance and in some places this is the only mode of transportation. Such a situation is likely to continue for a long time in future. *Bhutia* ponies have proved themselves eminently suitable for work on such terrains. There is thus a definite need and adequate justification to preserve and improve this breed to meet present requirements and also future needs. *Marwari* and *Kathiawari* as also *Manipuri* breeds have qualities to make good riding horses. *Manipuri* has the additional advantage of being surefooted on hilly terrain that make the animals of this breed suitable for work in mountaineous regions. Being indigenous breeds, all these animals are well adapted to the local agro-climatic environments. Maintenance and development of indigenous breeds of horses with riding qualities are desirable for various reasons.

32.2.64 With the development of local breeds of horses it should be possible to meet the civilian requirements of horses such as those needed for the police, border security forces, ceremonial functions and for equine based games, sports, pleasures and pastimes largely, if not wholly, out of indigenous stock. At present, these requirements are met almost wholly from the defence establishments. With proper organisation, it should be possible to establish a horse breeding industry in the civilian sector that would make it independent of the military establishments for obtaining supply of horses. The present arrangement has disadvantages. During emergencies the military establishments may not be in a position to meet the civilian need for horses. Moreover, the existence of an efficient horse breeding civilian organisation may be of advantage in times of crises in supplementing some of the military requirements.

32.2.65 Home tracts of the breeds viz., Manipur for *Manipuri* and

Rajasthan for *Marwari* and Gujarat for *Kathiawari* breed would be the logical locations for horse breeding farms, and for maintenance and development of breeds of riding horses. Jammu and Kashmir and Himachal Pradesh would in our opinion be suitable for the development of the *Bhutia* breed. In consideration of the small number of 'good' specimens that are now left in different breeds, it would be preferable to concentrate on development work of each breed only at one centre to begin with. For the development of indigenous horse breeds in selected States it would be necessary for the Central Government to initiate action that would encourage the concerned State Governments to establish the farms. There should not be any great difficulty for the State Governments to locate suitable sites and enough land for establishing horse breeding farms but they would possibly require technical expertise and guidance from the Central Government, at least in the initial stages. Subsequently the State Governments may be in a position to maintain and operate the farms depending wholly on their own resources. We recommend that preservation and development of indigenous breeds of horses should be undertaken as centrally sponsored programmes on the lines of establishment of Cattle Breeding or Sheep Breeding Farms.

32.2.66 In addition to the horse breeding farms in the States, we recommend the establishment of a National Equine Breeding Farm (NEBF) under direct control and management of the Central Government. The objective of the NEBF would be to produce high class stallions and brood mares of different breeds as also donkey stallions as are presently being done by the military establishments. Such an organisation will serve as a second line of defence for the military establishments to fall back upon in the event of an emergency. Without such an arrangement resort will have to be made to heavy imports of equine as was done during the Chinese attack. During that crisis the shopping list abroad included horses and mules to carry guns in the hills along with sophisticated items of defence stores and animals of whatever quality any country could offer were purchased. Such an eventuality would not occur again if an efficient horse breeding farm is established in the civilian sector. We also recommend that the NEBF should in a small way make a beginning in breeding race horses in the public sector. Such a step by the NEBF would serve as an additional check on various alleged malpractices now being indulged in by private race horse breeders. If the NEBF succeeds in attaining the objective of producing superior quality race horses, donkey stallions and other horses for equestrian games and sports it may be possible to secure a foreign market for these animals to earn foreign exchange.

32.2.67 Rajasthan, Maharashtra, Karnataka, Haryana and Gujarat

are the States which, in our opinion, should be suitable for the establishment of the National Stud Farm. We have been informed that there are good prospects of obtaining a large plot of irrigated land in Rajasthan Canal Zone for this purpose.

32.2.68 The decision on the size and strength of the State horse breeding farms should be made by mutual discussion and agreement among Central and State Government authorities. For the NEBF, the requirements should be decided by the EDB and negotiations held with a State Government to obtain the needed facilities.

32.2.69 One of the prerequisites for breed development of livestock is to have clearly defined characteristics of a breed and a set of measurable standards for the assessment of the quality of animals. Maintenance of suitable records is also essential. Unfortunately none of these essential prerequisites are available in respect of the indigenous breeds of horses. The ICAR has been concerned with the work of defining the breeds in different species of livestock. We, therefore, recommend that the ICAR should undertake the task of defining the Indian breeds of horses and specify the measurable standards for judging the quality of the animals.

32.2.70 For maintenance of records, State Departments should open Stud Registers. In addition to the animals in a farm that would find a place in the Stud Register, selected mares in neighbouring villages may also be registered. These selected mares should be included in the breeding programme so as to function almost as a part of the farm herd. The National Stud Register should be opened by the Union Ministry of Agriculture and Irrigation. All the imported stock of equines must be compulsorily registered and their particulars recorded in the National Stud Register. The progeny of these animals should also be registered.

Stationing of Studs

32.2.71 While steps are being taken for the establishment of horse breeding farms and promotion of equestrian sports and games, some immediate action is necessary to arrange for the breeding of the local female equine stock with some superior type stallions. Some of the States like Gujarat, Haryana and Punjab were stationing horse or jack stallions in veterinary hospitals or other locations for horse, donkey and mule breeding. Many of such stud centres have since been closed down mainly because of insufficient use of the stud animals. In the interest of equine breeding we recommend that a reappraisal of the situation should be made and steps should be taken by the State Governments, where equines are important, for reopening the centres

and increasing the number of horse and jack stallion studs.

32.2.72 The locationing of the stud centres should be done after a careful survey and re-examination of animal distribution, animal characteristics and prospects of good utilisation of the stud animals. The possibilities of underutilisation of the stud animals are there at present and this fact should be accepted. However, maintenance of these studs by Animal Husbandry/Veterinary Departments of the State is justified in consideration of the obligation of the State to render assistance to the weaker section of the community. With equine development activities increasing in the States in the future there should be increasing utilisation of the horse and jack stallions. That the animals of superior quality should be selected as stud and maintained properly at the stud centres need no emphasis. Maintenance of proper records of matings, foals born, survival rate of the young and preferably its performance and disposal are essential for all Stud centres. This was sadly neglected in the past in most of the Stud centres. The objectives of Stud centres cannot be attained without maintenance of proper records. Procurement of good jack stallions for the breeding of donkeys or production of mules may not be quite easy. The Defence establishment may be in a position to render help in this connection.



3 CAMEL

32.3.1 Camels have very limited distribution in the world and are found only in Asia and Africa. Of the two species of camels namely, the one-humped camel (*Camelus dromedarius* Linn) and the two-humped (*Camelus bactrianus* Linn), only the former is now found in India.

32.3.2 Amongst countries having camels, India possesses the largest number. Of an estimated world camel population of 4.6 million in 1961, almost twentyfive per cent was contributed by India. The distribution of the camel is very uneven in different parts of the country, there being States having none at all or an insignificant number.

32.3.3 Most of the camels found in the country are in Rajasthan, Haryana and Punjab. A fairly good number is also found in Uttar Pradesh and Gujarat. Rajasthan accounts for about 70 per cent of the camel population in the country. Out of the camel stock in the State, nearly 84 per cent is concentrated in 11 arid western districts.

32.3.4 Camels are well adapted to arid regions and are able to subsist under drought conditions on the coarsest available feeds and under deprivation of water for a number of days. The adaptability of the

camel to drought conditions becomes strikingly obvious from the observation that between 1966 and 1972 when severe drought conditions were experienced in the eleven western districts of Rajasthan there was a decline in cattle, buffalo and sheep population, but the population of camel showed an increase from 0.56 million to 0.62 million.

Types of Camels

32.3.5 Camels in India can broadly be classified from their utilisation point of view, into two groups, the baggage camels and the riding camels. The baggage camels are sturdy and of heavier built. They are of two kinds, one suitable for the plains and the other for the hilly regions. The latter are powerful animals with a compact body frame and shorter legs and better muscular development than the former. Heavy loads of 300 kg or more can be carried by these animals at a slow pace over a distance of 32 c km a day. The riding camels with a lighter built are capable of covering as much as 100 km at a stretch. For a short distance they can run as fast as a horse and during the course of travel for a day they are capable of covering the distance at an average speed of 10-11 km per hour.

32.3.6 There are groups of camels with some body characteristics by which they can be classified as distinct types. Locally, these are recognised as distinct breeds. These types or breeds include the Bikaneri, Jaisalmeri, Sindhi, Marwari, Mewati, Mewari, Jalori and Shekhawati. Of these, the Bikaneri is the principal breed which has been defined by a duly constituted committee appointed by the Rajasthan Government.

Population Trend

32.3.7 The camel population reported in the quinquennial livestock censuses from 1951 onward is shown below:

Year	Population (in thousand)
1951	629
1956	776
1961	903
1966	1,028
1972	1,126

From these figures it appears that there has been a steady increase in camel population since 1951. Camels constitute only a very small fraction—about 0.3 per cent of the total livestock population in the country. The population figures are, however, of very doubtful reliability. A scrutiny of the Statewise distribution of camels in two quinquennia between 1961 and 1972 (Appendix 32.7) shows erratic

trends in population for which no plausible reasons can be found. For example in Maharashtra, during the quinquennium between 1961 and 1966, the population showed 100 per cent increase, whereas in the subsequent quinquennium a 50 per cent decrease was recorded. In Gujarat only a rise of 2.3 per cent in population was reported between 1961 and 1966 but a 40 per cent rise was recorded between 1966 and 1972. In Uttar Pradesh a 16.3 per cent rise was shown during the first quinquennium followed by a 14 per cent decline during the next five years. These changes do not appear to be related to any trends in economic, social or agricultural conditions in different States or groups of States and are extremely difficult to understand and explain. The figures for individual districts in the States are likewise unsuitable for study in depth for drawing valid conclusions.

32.3.8 In the absence of reliable statistics on population, utilisation and disposal of animals, planning for development of camels becomes a difficult proposition. In the livestock census, besides enumeration of population, no other information on camel is available. There is no sexwise or broad agewise classification like adult or young-stock of the camel population in the census. In Section 2 on Equines, we have recommended the establishment of a Committee for advising the Government on the characteristics of different livestock on which information should be collected during livestock censuses. The same Committee should also consider the essential information that should be collected for effective planning for camel development.

Breeding and Management

32.3.9 Traditional system of camel breeding practised over centuries is undergoing basic changes under compulsion of changed situations. Under the traditional system, breeding of camels which was and still is most extensive in Rajasthan is done by professional camel breeders owning large herds of camel in areas that provide adequate grazing facilities for maintaining the animals in good condition. In the past, the rulers of the princely States of Rajasthan, used to evince keen interest in camel breeding. In Rajasthan there were vast areas available for camel grazing. In all the princely States several professional camel breeders had good sized camel breeding farms of their own. Besides these professional breeders, every landlord used to maintain camel herds and great care was exercised in the breeding of the animals. Excellent camel herds were owned by Bikaner and Jodhpur Darbars. Alwar Darbar also maintained elegant camels very good for transportation work. Because of these reasons good camels could be found in many places in Rajasthan. Very best ones, of course, were to be found in

limited areas. In Bikaner which has the best camels in the world, the camel breeders were given several facilities for the upkeep of the animals. There used to be extensive grazing areas for camels and no tax was levied on their grazing. Drinking water from all the wells in the States was allowed free for the animals. Like branded ox bulls, good stud camels called "Mehias" were branded and let loose by individuals interested in camel improvement. These stud camels used to move in camel herds during winter and were free to graze anywhere during the off breeding season. The stud camels could not be put in the animal pounds even if they damaged standing crop. Some of the large camel breeding herds had 500 or more she camels.

32.3.10 Camel breeding in Rajasthan was not mere multiplication of stock. The breeders with the hereditary art of breeding that they had acquired and with their keen observation and native intelligence used to breed camels with a definite objective, true to a particular type suited for a specific purpose. It is with deliberate efforts that the camel breeders in Rajasthan evolved the distinct types of camels like the Bikaneri, Jaisalmeri etc. Outside Rajasthan, breeding of camels was done to a considerable extent in the adjoining States, but no special type of camels has been evolved as a result of these breeding activities.

32.3.11 The conditions favourable for breeding of camels are fast disappearing. Due to growth in human population and development of desert regions, the land previously available for grazing by camels is shrinking at a rapid rate. Following Partition much of the land that was available for grazing of camels in the adjoining States of Rajasthan was brought under the plough because of the compulsive necessity of rehabilitation of the refugees. As a consequence, the few camel breeders outside Rajasthan and Kutch are at present having a pitiable existence with small herds of camel in poor condition. Under these adverse conditions, breeding of camels by these breeders has come to a stage of mere multiplication of stock. It may not be long before these camel breeders will completely go out of business.

32.3.12 There is a distinct shift noticeable in the utilization of camels for meeting changing human requirements. In the past camels were prized most for their speed of travel and capacity to traverse long distances at a stretch in the desert. Their ability to carry heavy loads, endurance and staying power, ability to obtain nutrition by grazing in the desert and capacity to withstand water deprivation for long periods are the other invaluable qualities for travel in the desert. With development of desert regions, construction of roads and with introduction of mechanised transportation, the importance of the camel as a means of transport in the desert is decreasing but the importance of the animal is

increasing for agricultural operations. This brings in its wake newly developing situations in management of camels concerning both breeding and feeding.

32.3.13 Breeding of animals for genetic improvement without ensuring adequate nutrition is meaningless. So far, management of camels for breeding and feeding could be best accomplished by keeping the animals under ranching conditions where they could obtain good grazing and browsing over extensive land areas. Such management conditions enabled camel breeders to maintain large breeding herds economically to make camel breeding profitable. Large herds also provided scope for greater intensity of selection for producing superior quality animals.

32.3.14 The situation has greatly changed for camel breeding even in Rajasthan where the camel is one of the most important livestock. Continuous diminution in the areas available for camel grazing due to increased cultivation, legislation on preservation of forest and closing the areas altogether to camel grazing and reclamation of large tracts previously used for camel grazing for the canal projects have perforce led to camel breeding activities getting limited to restricted localities. One of the consequences resulting from the squeezing of the breeding activities is that the distinct types of camels that existed in the past in Rajasthan are getting mixed together and they may lose their separate identities. Except in Rajasthan where the camel breeders were keen in retaining and improving the breed types, breeding of camels in other parts of the country was practised in a haphazard manner without any consideration of a particular type. The result was the production of crossbred or dogla camels which can be found throughout the country.

32.3.15 Under the changed and changing situation whether there is a need to make a special endeavour to retain the distinct types of camels that were evolved in the past, is a matter which needs careful study. In paragraph 32.3.28, we have recommended that research studies on camels should be undertaken at the agricultural universities in the areas where there is inadequate knowledge at present. The types of camels that would be most suitable for different agricultural operations to which they are being put to in increasing numbers, should be included as a subject of study.

32.3.16 Because of diminution of camel grazing areas in Rajasthan, the number of camel breeders as also the size of their herds are decreasing. Whereas in the past several large sized herds with 300—500 or more she camels could be found, a camel herd with 300 head of animals is now rare and very few camel breeders can now be found with a herd of 100 animals. Breeders with fewer animals than 50 are

in some places joining together to make a common herd and keep good stud camels with the herd.

32.3.17 No camel breeder can afford being in business, keeping the animals under stall feeding as the cost of maintenance of the animals would be prohibitive. Although the situations have greatly changed in both the places still there is some scope left for camel breeding in Rajasthan and Kutch by maintaining the animals on grazing under ranch conditions. Desert areas in Bikaner and Jodhpur and the hilly areas of Udaipur and Kota provide facilities for grazing of the animals of the camel breeders. There are extensive areas in Kutch where camels can be maintained very well on grazing. As a grazing ground for camels, Kutch may be even superior to Rajasthan. For mass scale propagation of breeding stock and production of superior quality stud animals, camel breeding activity should be kept concentrated mainly in these two areas. Organisation of efficient co-operative societies of camel breeders would be of help in procuring good quality stud camels, obtaining better grazing facilities for the animals, securing institutional credit facilities and in obtaining profitable marketing channels for the animals they produce. We recommend that the Animal Husbandry Departments of Rajasthan and Gujarat should take the initiative in organising the camel breeders into co-operative societies. Financial assistance and technical guidance necessary for this purpose should be provided by the concerned State Government.

32.3.18 Maximum utilisation of a superior quality stud animal is possible through artificial insemination (AI). Keeping in view the fact that only a few good quality stud camels are now available, serious consideration should be given to use of AI in camels. It is reported that artificial insemination has been used with good success in the USSR¹. As far as we are aware, this system of breeding has not been attempted so far in India and the technique of AI in camels is also not known in the country. We, therefore, recommend that the possibilities of training one or two young well qualified and competent persons in the Department of Animal Husbandry, Rajasthan in artificial insemination of the camel in the USSR for a period of six months or so, may be explored. In case it is possible to arrange the training, early steps should be taken to depute the selected persons for this purpose. Only persons actively engaged in AI work should be selected and deputed for training.

32.3.19 For hand mating of camels in Rajasthan, Haryana and Gujarat we have, in the Interim Report on Desert Development, recommended stationing of stud camels in suitably located centres and

¹ Survey (1954-56) Report on the Indian Camels by Durga Dan—Indian Council of Agricultural Research New Delhi—p.44.

the operation of the centres broadly on the pattern of Key Village Scheme for cattle development. Such facility should be developed also in Punjab.

Feeding

32.3.20 While discussing breeding of camels it has been indicated that it is possible to maintain large herds of camels in desert areas economically only under conditions of ranching with animals obtaining their nutrition mainly by grazing and browsing. Areas available for camel grazing are progressively getting smaller and with utilisation of the camel for agricultural operations number of camels maintained under stall feeding is increasing. Very little scientific studies have so far been done on camel nutrition and on formulation of least cost balanced ration from locally available ingredients for the camels engaged in different kinds of work. In paragraph 32.3.28 we have recommended initiation of research studies on camels in those aspects where knowledge is still inadequate. Nutrition of the camel and formulation of least cost balanced ration are two fields in which very little research studies have been made so far. These studies should, therefore be undertaken without any delay.

Camel Diseases

32.3.21 Authentic data regarding the incidence of camel diseases in the country are lacking as comparatively a very small percentage of diseased and dead camels has been subjected to laboratory examination. However, the available information shows that surrah (trypanosomiasis) is the most serious disease of camels in India. The disease usually runs a chronic course and the animals may not exhibit clear clinical symptoms for a long time. However, if the infected animals are worked hard, the disease assumes an acute form causing death within a few months. A fairly high percentage of she camels also abort due to surrah, causing huge loss to the camel breeders. Several proprietary drugs like 'naganol', 'antrypol', 'antricide' are highly specific for in the treatment of surrah, but all of these are in very short supply as these have to be imported. We recommend that arrangements for their manufacture in the country should be made at an early date. However, till these drugs become available indigenously, the Animal Husbandry Division of the Union Ministry of Agriculture and Irrigation should ascertain the country-wide requirements of these drugs for the treatment of camels and equines from the State Directors of Veterinary Services and arrange for their import. Some of the other

diseases reported in camel are anthrax, black-quarter, tuberculosis, haemorrhagic septicaemia, sarcoptic mange, pneumonia etc. We have given a broad outline for the control of some of these diseases in Chapter 35 on Animal Health. We have also given in that Chapter recommendations for organisation of preventive veterinary medicine service and disease diagnostic service in the country. With implementation of those recommendations and strengthening of animal health service, losses due to camel diseases will also get considerably reduced.

Utility of Camel

32.3.22 The camel is a multipurpose animal. Its principal use is for riding as pack animal, for pulling the plough or carts. It is also used for drawing water by the persian wheel, crushing oil seeds in oil ghanies and for crushing sugarcane. With suitable yoke it can replace a pair of bullocks for most agricultural operations. It is used by the police and Border Security Force for patrol and guard duties. In the past camels had a singularly important role in desert warfare. India had the most eminent role in the maintenance of camel corps for fighting. The army has, however, disbanded the camel corps recently.

32.3.23 The female camels in some areas are quite heavy milkers and are milked like cows for 6 to 8 months after the calf is born. Yields as high as 10 litres per day after the suckling of the calf have been recorded. Camel milk is generally not sold as an item of trade like cow or buffalo milk but is used for products such as *khoa* or *mawa* and is often mixed with cow, buffalo, sheep and goat milk and sold in the market. Camel milk does not give a firm curd on curdling like cow/buffalo milk and as such cannot be used for products like *dahi* and *ghee*. The milk is good for human nourishment.

32.3.24 Camel hair is a valuable commercial commodity. The body of the camel has an outer coat of coarse hair and an inner coat of fine woolly hair. The fine woolly hair makes high quality blankets, rugs and fabrics for warm garments. Blankets made out of camel hair are superior to woollen blankets. Superior quality painting brushes are made from camel hair. Camel hair alone or mixed with goat hair, is used for making ropes which are employed as such or made into bags for the storage of grain or for mats for sitting.

32.3.25 Camel meat is good food. Camel leather is used for making shoes and many kinds of other goods. Huge waterbags are made of camel hide for bulk transport of water. Camel guts are used for making fanciful handicraft articles as cottage industry. Camel dung is extensively used as manure.

32.3.26 The camel cannot be replaced by any other livestock in areas where it is in use. In fact, whereas camels are being replaced by mechanised vehicles for transporting men and materials where roads have been developed, the camel is replacing the horse and the bullock in some other situations. In the construction of Rajasthan canal project camels have proved more economical than mechanised or other kinds of transport for carrying earth. The camel work for the Rajasthan Project attracted camelmen from as far as 200 km from the site. There is yet a shortage of camel carts and the project authorities propose to give loans of Rs. 3,000 each to camelmen on the condition that they would use the carts for project work.

Camel Development

32.3.27 Even though camels render multifarious benefits to the people in desert areas, very little attention has so far been given to its development, applying modern knowledge and technology. For centuries camel breeding is being done in different parts of Rajasthan by professional but mostly illiterate breeders. Through the traditional art of breeding that they had acquired and with their native intelligence and keen observation these traditional breeders had been producing many excellent quality animals. The Bikaneri camels as developed by these breeders are the best in the world. A number of fine specimens can also be found in other breed types like Jaisalmeri, Marwari, Mewati etc. These camel breeders, however, lacked knowledge on nutrition and sanitation. If the benefits of scientific knowledge and technology could be combined with the traditional art of breeding that the camel breeders had acquired, the achievement would have been more impressive.

32.3.28 In consideration of these possibilities and to make a beginning, the ICAR sanctioned a scheme for camel survey in 1954. The scheme was in operation for about three years. It is unfortunate that the survey was based mainly on verbal enquiry from illiterate camel keepers and not on direct observation and scientific study. Hence it would be unwise to plan camel development programmes on the basis of this survey work. In 1956, the ICAR sanctioned the establishment of a camel breeding farm and 10 stud centres which were to operate broadly on the pattern of the All India Key Village Scheme. The object was to collect scientific data on the camel and to improve the breed of camels by selective breeding. Due to recurrent famine conditions in Bikaner where the farm was established and for other reasons, the farm and stud centres did not operate satisfactorily and the information collected was not considered to be of adequate scientific interest. The farm was, therefore, handed over to the Department of Animal

Husbandry, Rajasthan, for being continued as a non-research development activity. The Rajasthan Government is considering to hand over the farm to the College of Veterinary and Animal Sciences of the University of Udaipur for the purpose of teaching, research and development. The ICAR also sponsored a visit to India by an eminent foreign expert in anatomy for a detailed anatomical study of the camel. After the visit of this expert, schemes were sanctioned for detailed studies of anatomy and physiology of the camel. In addition, the College of Veterinary and Animal Sciences, Bikaner has carried out some studies on these subjects. Scientific knowledge on the physiology, nutrition, husbandry, disease incidence, parasitism etc. of the camel is, however, still very meagre. We, therefore, recommend that the ICAR should initiate research studies on these aspects of the camel in which knowledge is inadequate in the agricultural universities in Rajasthan, Gujarat, Punjab and Haryana where the camel is an important livestock.

32.3.29 In the Interim Report on Desert Development we have recommended expansion of the Camel Farm at Bikaner. This is necessary for the research studies that should be undertaken by the College of Veterinary Science and Animal Husbandry of the Agricultural University, Rajasthan, and for other camel development work that we have suggested. The linking of the expanded camel farm with a number of camel development blocks in different districts on the pattern of the Key Village Scheme has been recommended in the Interim Report for camel development work. We also recommended that the outlay for the expansion of the farm and its activities could be shared jointly by the ICAR, Government of India and the Government of Rajasthan as the camel breeding farm at Bikaner will help in the improvement of the stock in the neighbouring States as well. Camel development work requires several years to yield results. Therefore, action should be taken soon to implement the recommendations made by us.

4 YAK

32.4.1 The yak also called the grunting ox, *Bos* (Poephagus) *grunniens* Linn [Hindi—*Ban chour* (wild); *Chour-gau* (domesticated)] is an animal adapted to high altitudes. Yak is a native of the Tibetan Plateau and the surrounding countries in Central Asia. They are found in altitudes of about 4,300 to 6,100 metres above sea level. Wild yaks live in large herds in cold, high altitude, desolate regions where other livestock would not survive. Grown up bulls make smaller groups of their own. Winter is the breeding season and the

calves are dropped during the following autumn season.

32.4.2 As these animals are little known outside their habitat, a brief description of the animal is given below. It is a massively built animal with a drooping head, high humped shoulders, straight back and short sturdy legs. Large wild yak bull stands 1.8 m high at the shoulder hump. It has a coat of black, coarse shaggy hairs, particularly long at the flank, covering chest, shoulders, thighs and lower half of the tail. The tail has long hairs. It resembles the tail of the horse. Grey colour of the muzzle and a grey coat on the head and the neck is not uncommon. Domestic yaks of both sexes are smaller in size than the wild yak and exhibit various coat colours. Piebald or pure white yaks are quite common. The horns are round, spreading outward and upward.

Population and Distribution of Yaks in India

32.4.3 In India, yaks are found in Ladakh valley of Jammu & Kashmir; Pangi, Sangla, Lahaul and Spiti valleys of Himachal Pradesh; Uttarkhand in Uttar Pradesh and a small number in Arunachal Pradesh. These animals generally live along the snow line moving up during the summer and down during winter. They can live on grasslands at high altitudes which other species of livestock are unable to utilise.

32.4.4 The yak population in Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh in 1961 and 1966 as enumerated in the livestock censuses is given below*:

State	Population	
	1961	1966
Jammu & Kashmir	17,779	13,562
Himachal Pradesh	3,305	3,226
Uttar Pradesh	3,349	718

Even after three years of completion of livestock census the population figures of yaks in 1972 (census of 1971 was held in abeyance for a year) are not available. There was a marked decline in the population of yaks between 1961 and 1966, particularly in Uttar Pradesh. The decline may be attributable to various reasons. Yaks can no longer be imported from the breeding areas in Tibet. During 1961 to 1966, there was high mortality in the yak population due to disease and famine conditions in the wake of influx of Tibetan refugees with their livestock in India. Development of roads and air-transport in the high altitude regions have made yak rearing unprofitable in a number of places. In the limited areas where yaks are still found, they are playing

* Population figures for Arunachal Pradesh are not available.

an important role in contributing to the economy of the local inhabitants. In some places yaks are considered absolutely indispensable. It should be realised that yaks will continue to be valuable in inhospitable, underdeveloped and difficult regions with poor transport facilities since these animals are able to thrive and provide useful products for the inhabitants in those areas under conditions which other livestock, particularly the more productive ones, are unable to withstand. If and when those areas are developed it would prove more profitable to maintain other more productive livestock. Even if the area is not developed but good communication roads are constructed, it would possibly be more economical to transport the livestock commodities from the areas where those could be produced at much lesser cost rather than attempting to produce the livestock products locally at considerably higher cost.

Usefulness of the Yak

32.4.5 Yaks are used to a considerable extent for cultivation, riding and as pack animals. They are also used for pulling small carts over small distances. Yaks are particularly valued as a source of supply of meat. Yaks are also an important source of milk supply. It is reported that the female yaks in India yield $1\frac{1}{2}$ to $2\frac{1}{2}$ litres of milk testing 5 to 6 per cent fat. Butter and cheese are also made out of yak milk, particularly during summer when the animals are usually taken to higher pastures. We are informed that crossbred females born out of ox female by yak male, produce 3-4 litres of milk and these constitute a source of commercial milk production in some areas. Yak skin made into rough leather is used for various purposes. The hair, with or without other animal fibres like goat hair is made into ropes or woven into bags and blankets. The tail tufts, particularly if white, are valuable items of commerce and are greatly prized for ceremonial purposes in temples and monasteries. Dung of yaks is used as manure and in treeless plateaus this may be the only source of fuel. Crossing of yak males with cows is quite common. The females born out of such crossing are fertile but the males are infertile and hence can be used only for work and supply of meat. The crossbred males are known as dzo in Tibet and choru in Himachal Pradesh and the females are called dzomo and chaori respectively in the two places. Different names are, however, used for such crosses in different areas. The dzomo is supposedly a higher yielder of milk than the yak female or the female oxen and is popular as a dairy animal in the areas where yaks abound. There is a popular belief that the dzo and the dzomo are as well adapted to high altitude areas as the yaks but are better adapted to lower

altitudes. It is possible to cross the dzomo with either yak or cattle. The males out of such crosses are like dzo infertile. It is reported that the female crosses are not as easy to maintain as the dzomo and they are also poorer milk producers.

Planning for Yak Development

32.4.6 A great handicap in the planning for development of the yak is the lack of knowledge about the animal. This is one of the least studied domestic animals. Published literature on yaks is extremely scanty and no research investigation to study the physiology, disease incidence or husbandry of these animals appears to have been made so far as no published reports are available. In 1960, the ICAR initiated a scheme for a survey of the yak in India. The scheme lasted for three years. Most of the information collected in the survey is based on oral enquiry without any direct observations. The authenticity of the information obtained by oral enquiry is questionable. As such, it would not be advisable to plan for yak development on background information of questionable value. In Himachal Pradesh, Jammu & Kashmir and Uttar Pradesh some schemes were initiated for yak development in the sixties without any proper planning. The scheme for improvement of the species was limited to purchase of 'selected' healthy yak males from the villages and stationing these animals at chosen locations for production of better quality yaks and yak crosses. The selection of the male breeding yaks was based entirely on phenotypic body characteristics of the animals. There was no proper record keeping to assess the results of operation of the schemes. It is not surprising that no tangible results have come out from such attempts at improvement of yaks.

32.4.7 The Himachal Pradesh Government has established a yak breeding farm near Chitkool in Sangla valley. It has recently been handed over to the Agricultural University, Himachal Pradesh for research and development. We are of the opinion that this is a move in the right direction since it is essential to gather a great deal more knowledge about the yak by systematic research studies to make effective planning for yak development. While endorsing the decision of the Himachal Pradesh Govt. we would however, like to point out that research investigations on yaks relating to physiology of nutrition, reproduction and production, disease incidence and pathology of the common and more serious diseases and husbandry should be carried out by really capable and highly qualified persons, as practically nothing is known about the animal on these important aspects. Beside this, because of the limitation of the size of the yak herd at Chitkool, we

consider it essential that field studies on the yaks at selected locations should be undertaken. Along with research studies to learn more about the animal, socio-economic studies should also be undertaken to ascertain the economics of utilisation of yaks for different purposes and the social implications of yak rearing. With such combined studies it should be possible to formulate effective plans for yak development in future and relating these to the economic betterment of the yak owners. We recommend that the ICAR should initiate a coordinated research programme for yak development in Jammu & Kashmir and Himachal Pradesh.

5 SUMMARY OF RECOMMENDATIONS

32.5.1 The following is a summary of the important recommendations made in the text of this chapter.

Pig

1. The Institute of Agricultural Research Statistics (IARS) should develop proper methodology for obtaining dependable population estimate of pigs through sample surveys during intercensus periods.

(Paragraph 32.1.6)

2. The IARS should undertake research investigation on economics of pig production on a priority basis.

(Paragraph 32.1.7)

3. Surveys should be conducted at regular intervals for determining the demand, consumption and supply of pork and pork products.

(Paragraph 32.1.10)

4. In all cities and big towns where pigs are slaughtered regularly arrangements should be made for licensing of pig slaughtering.

(Paragraph 32.1.11)

5. The IARS should evolve sampling technique for estimation of the number of pigs slaughtered in rural areas.

(Paragraph 32.1.11)

6. A cell should be created in the Directorate of Marketing and Inspection of the Central Government for regular periodic surveys on livestock and livestock products.

(Paragraph 32.1.11)

7. Immediate steps should be taken to remove the constraints standing in the way of undertaking suitable pig breeding programmes

in the Regional Pig Breeding Stations and the Pig Breeding Farms/Units near the bacon factories.

(Paragraph 32.1.14)

8. Bacon factories should adopt a pricing policy for pork and pork products that would encourage the farmer to take to pig rearing.

(Paragraph 32.1.14)

9. Producers of pork and pork products in the private sector should be induced to obtain carcasses through licensed pig slaughter houses and a system should be evolved for strict quality control.

(Paragraph 32.1.16)

10. The bacon factories should take steps to popularise their products. This should include consumer education programmes.

(Paragraphs 32.1.17 and 32.1.45 to 32.1.47)

11. The nucleus breeding herd in the Regional Pig Breeding Stations should be strengthened.

(Paragraph 32.1.22)

12. Considerably more exotic pigs are required to be imported for undertaking selective breeding programme on scientific lines in the Regional Stations.

(Paragraph 32.1.22)

13. A comprehensive coordinated breeding programme should be drawn up for all the seven Regional Stations. Simultaneously, a well planned programme for commercial pig production should be undertaken so that genetic improvement of the stock and adequate supply to the bacon factories can be achieved.

(Paragraph 32.1.22)

14. For some of the north eastern States breeds like Berkshire, Hampshire, Saddleback or Poland China should be selected for breeding as the people in these areas prefer black coloured pigs.

(Paragraph 32.1.22)

15. Artificial insemination (AI) should be tried in the pig to find out how this method of breeding will pan out under Indian conditions. If found satisfactory, it should be adopted in the important pig breeding stations.

(Paragraph 32.1.23)

16. Attempts should be made to get Indian manufacturers of AI kits interested in fabrication of AI kits for swine.

(Paragraph 32.1.23)

17. A coordinating cell should be created for proper execution of the Coordinated Pig Breeding Programme.

(Paragraph 32.1.24)

18. The working programme of the All-India Coordinated

Research Project of the Indian Council of Agricultural Research (ICAR) on pig breeding should be suitably modified and the herd strength enlarged to obtain useful results.

(Paragraph 32.1.25)

19. Agricultural universities should undertake studies on pig breeding with indigenous and exotic breeds of pigs.

(Paragraph 32.1.26)

20. The programme for pig development in the north eastern States should be implemented soon.

(Paragraphs 32.1.29 and 32.1.30)

21. So long grain position remains difficult, greater use of agro-industrial byproducts should be made in the formulation of pig ration, ensuring satisfactory production performance.

(Paragraphs 32.1.32 to 32.1.34)

22. Research studies on the nutritional requirements of various classes of pigs should be undertaken without delay.

(Paragraph 32.1.35)

23. For evolving pigs with better feed conversion efficiency, suitable breeding programmes should be initiated as soon as possible.

(Paragraph 32.1.36)

24. The Indian Veterinary Research Institute should intensify research to develop an efficacious and inexpensive vaccine for protection of pigs from foot and mouth disease.

(Paragraph 32.1.38)

25. Studies should be undertaken on designing and construction of suitable cheap houses for pigs using locally available material.

(Paragraph 32.1.40)

26. The Government should permit importation of a few sonoscopes to serve as a model for fabricating the equipment in the country.

(Paragraph 32.1.41)

27. Necessary steps should be taken to make institutional credit facilities available to pig farmers.

(Paragraph 32.1.43)

28. Till such time chilled pork products can be supplied at reasonable prices consumption of fresh pork should be encouraged.

(Paragraph 32.1.44)

29. Meat Food Products Order, 1973 should be implemented and rigidly enforced to prevent the private bacon factories from procuring carcasses through unauthorised sources.

(Paragraph 32.1.49)

30. The Central Food Technology Research Institute should extend research studies on processing and packaging of pork and pork

products so that these products can be manufactured in India matching the standards attained by countries with international reputation for high quality pork and pork products.

(Paragraph 32.1.50)

31. For imparting scientific knowledge on different aspects of pig production and processing of pork, a three tier training programme should be organised.

(Paragraph 32.1.51)

Equines

32. The Union Ministry of Agriculture and Irrigation should constitute a Committee to advise how and on what points information should be collected and enumeration done during the livestock census.

(Paragraph 32.2.10)

33. Detailed critical study should be made about the needs and requirements of people engaged in equine based trade for planning equine development. Separate studies are required for trades based on horses, mules and donkeys.

(Paragraphs 32.2.43 to 32.2.45)

34. Equine development programmes aimed at providing assistance to the weaker section of people should be fully or largely supported by the Central Government as its contribution towards social justice and for removal of regional imbalances.

(Paragraph 32.2.46)

35. There should be collaborative work between the civil and military establishments for development of national equine wealth.

(Paragraph 32.2.48)

36. The Government should take full control of horse racing in the country.

(Paragraphs 32.2.49 and 32.2.50)

37. A fresh review of the entire field of horse racing and race horse breeding industry is necessary. The Union Ministry of Agriculture and Irrigation should soon convene a meeting of all interests and specialists concerned with import, breeding, racing and training of horses for this purpose.

(Paragraphs 32.2.51 to 32.2.53)

38. Breeding of race horses may for the present be left in private hands but immediate steps should be taken for more effective control on various malpractices alleged to be now prevalent.

(Paragraph 32.2.54)

39. An Equine Development Board (EDB) should be established

to exercise control on racing and all organised equine breeding activities.

(Paragraph 32.2.55)

40. To control race horse breeding, steps should be taken to register all private studs with the EDB.

(Paragraph 32.2.56)

41. The EDB should be responsible for making assessment of freshblood requirement of exotic stock. The Union Ministry of Agriculture and Irrigation should constitute a purchasing mission from time to time on advice from the EDB for procuring superior quality horses from abroad.

(Paragraph 32.2.57)

42. Steps should be taken to maximise the utilisation of imported and other high quality horses.

(Paragraphs 32.2.58 and 32.2.59)

43. As equestrian sports are excellent activities for body building, development of courage and daring, cultivation of sense of discipline, team spirit and love of animals, promotional activities for such games should be undertaken by both Government and private organisations.

(Paragraphs 32.2.60 and 32.2.61)

44. Preservation and development of indigenous breeds of horses is justified on utilitarian considerations and should be undertaken as Centrally sponsored programmes.

(Paragraphs 32.2.63 to 32.2.65)

45. A National Equine Breeding Farm should be established under the direct control and management of the Central Government.

(Paragraphs 32.2.66 to 32.2.68)

46. The ICAR should undertake the task of defining the Indian breeds of horses.

(Paragraph 32.2.69)

47. For proper maintenance of records, the State Departments should open Equine Stud Registers and the Union Ministry of Agriculture and Irrigation should open a National Stud Register.

(Paragraph 32.2.70)

48. In those States where equines are important animals, the Government should take steps for reopening the stud centres and increasing the number of horse and jack stallion studs.

(Paragraph 32.2.71)

49. Only horse/donkey stallions of superior quality should be selected for stud purposes and maintained properly at the stud centres. All stud centres must maintain proper records.

(Paragraph 32.2.72)

Camel

50. Studies should be undertaken to ascertain if under the changed circumstances there is a necessity of making a special endeavour to retain the distinct types of camels that have been evolved.

(Paragraph 32.3.15)

51. Animal Husbandry Departments of Rajasthan and Gujarat should take the initiative in organising the camel breeders to create Cooperative Societies. Financial assistance and technical guidance required for this purpose should be provided by the State Governments.

(Paragraph 32.3.17)

52. Possibilities of training one or two persons in the USSR in artificial insemination of camels should be explored.

(Paragraph 32.3.18)

53. For handmating of camels in Rajasthan, Haryana, Gujarat and Punjab stud camels should be stationed in suitable locations.

(Paragraph 32.3.19)

54. Research studies on nutrition of camels and on formulation of least cost balanced ration should be undertaken without delay.

(Paragraph 32.3.20)

55. Arrangements should be made for manufacture in the country of drugs specific for treatment of 'surrah' in camels.

(Paragraph 32.3.21)

56. Till such time the drugs become available indigenously, the Union Ministry of Agriculture and Irrigation should arrange for their import after making an assessment of the requirement of the whole country.

(Paragraph 32.3.21)

57. The Indian Council of Agricultural Research should initiate research studies on camels in the agricultural universities located in the States where the camel is an important livestock.

(Paragraph 32.3.28)

58. The camel farm at Bikaner should be expanded for research studies and developmental work.

(Paragraph 32.3.29)

Yak

59. Research studies on yaks should be undertaken at the Agricultural University, Himachal Pradesh as very little is known about the animal.

(Paragraph 32.4.7)

60. Because of the small size of the herd at the yak farm of the agricultural university, field studies on yaks should also be undertaken in selected locations.

(Paragraph 32.4.7)

61. Along with research studies on the animal, socio-economic studies should be undertaken to ascertain the economics of utilisation of yaks for different purposes and the social implication of yak rearing.

(Paragraph 32.4.7)

62. The ICAR should initiate a coordinated research programme for yak development in Jammu & Kashmir and Himachal Pradesh.

(Paragraph 32.4.7)

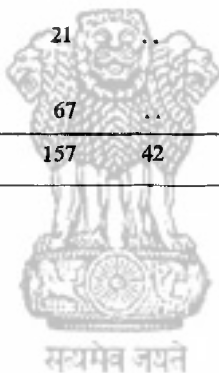


APPENDIX 32.1

(Paragraph 32.1.12)

Imported Purebred Stock of Pigs

Sl. No.	Project under which imported	Number of pigs						Total
		Large white Yorkshire	Land-race	Hampshire	Tamworth	Saddle back	Large Black Yorkshire	
1.	'Heifer Project' Inc. Philadelphia, USA	48	69	42	20	..	..	179
2.	'For those who have less', Australia	50	21	..	3	1	20	95
3.	'Freedom From Hunger Campaign' Ireland	63	67	..	..	..	..	130
	total	161	157	42	23	1	20	404



APPENDIX 32.2

(Paragraph 32.1.12)

Distribution of Improved Pigs in Different States*

Region	Number of pigs distributed to the farmers for breeding
North Eastern	
1. Assam (Gen.)	..
2. Assam (Hill Areas)	..
3. Mizoram	537
4. Meghalaya	..
5. Nagaland	1,073
6. Arunachal Pradesh	500
7. Manipur	73
8. Tripura	..
	2,183
Eastern	
1. Bihar	3,339
2. Orissa	..
3. West Bengal	1,025
4. Andaman & Nicobar Islands	..
	4,364
Northern	
1. Jammu & Kashmir	..
2. Himachal Pradesh	..
3. Haryana	529
4. Punjab	1,081
5. Chandigarh	..
6. Delhi	..
	1,610
Western	
1. Rajasthan	842
2. Maharashtra	197
3. Gujarat	..
	1,039
Central	
Madhya Pradesh	72
	72
Southern	
1. Karnataka	670
2. Andhra Pradesh	526
3. Tamil Nadu	796
4. Kerala	1,000
5. Pondicherry	..
	2,992

*Abstracted from the survey report by the Progressive Agro-industrial Consultants on Pork and Pork Production in India.

APPENDIX 32.3

(Paragraph 32.2.8)

Population of Horses and Ponies—1961 and 1966

State/Union Territory	1961	1966	% increase or decrease in 1966 over 1961
Andhra Pradesh	62,689	48,896	(-)20.0
Assam	16,803	34,848	(+)160.9
Bihar	132,545	115,878	(-)12.6
Gujarat	113,198	70,403	(-)37.9
Haryana	*	23,928	..
Jammu & Kashmir	69,433	65,797	(-)5.3
Kerala	408	426	(+)4.4
Madhya Pradesh	202,937	150,042	(-)26.1
Tamil Nadu	20,374	17,140	(-)15.9
Maharashtra	104,501	101,004	(-)3.4
Karnataka	41,444	64,874	(+)56.5
Nagaland	..	508	..
Orissa	58,166	66,616	(+)14.5
Punjab	*76,120	36,326	Not com- parable
Rajasthan	93,800	63,085	(-)32.8
Uttar Pradesh	296,328	229,845	(-)22.5
West Bengal	24,760	27,384	(+)10.5
Andaman & Nicobar Islands	5	5	..
Chandigarh	*..	47	..
Dadar Nagar Haveli	..	49	..
Delhi	6,040	5,165	(-)14.5
Himachal Pradesh	*5,702	14,512	Not com- parable
Laccadiv, Minicoy & Amandiv Islands	..	..	..
Manipur	529	803	(+)51.7
Pondicherry	..	73	..
Tripura	1,097	1,773	(+)61.5
all India	1,326,879	1,148,427	(-)13.5

*Figures for Punjab, Haryana, Himachal Pradesh and Chandigarh are not comparable due to reorganisation of these States.

APPENDIX 32.4

(Paragraph 32.2.8)

Population of Mules—1961 and 1966

(thousand)

State/Union Territory	1961	1966	% increase or decrease in 1966 over 1961
Andhra Pradesh	889	705	(-)20.7
Assam	..	661	..
Bihar	891	1,519	(+)70.4
Gujarat	842	703	(-)16.6
Haryana	*..	6,921	..
Jammu & Kashmir	3,442	6,899	(+)100.4
Karnataka	615	643	(+) 4.5
Kerala	31	8	(-) 74.2
Madhya Pradesh	2,109	2,202	(+) 4.4
Tamil Nadu	663	745	(+) 12.3
Maharashtra	923	1,316	(+)42.5
Nagaland	..	10,157	..
Orissa	341	1,100	(+)222.5
Punjab	*13,728	4,507	..
Rajasthan	912	886	(-) 2.9
Uttar Pradesh	22,434	27,365	(+) 21.9
West Bengal	262	595	(+) 115.9
Andaman & Nicobar Islands	..	..	..
Chandigarh	*..	27	..
Dadar Nagar Haveli	..	50	..
Delhi	1,121	1,276	..
Himachal Pradesh	*3,586	6,488	(+)80.9
Laccadiv Minicoy & Amandiv Islands	..	..	..
Manipur	24	2	..
Pondicherry	..	..	..
Tripura	..	..	..
all India	52,813	74,775	(+)41.6

* Figures for Punjab, Haryana, Himachal Pradesh and Chandigarh are not comparable due to

APPENDIX 32.5

(Paragraph 32.2.8)

Population of Donkeys—1961 and 1966

State/Union Territory	1961	1966	% increase or decrease in 1966 over 1961
Andhra Pradesh	82,172	67,450	(-)18.0
Assam	..	1,897	..
Bihar	38,801	32,810	(-)15.5
Gujarat	113,387	111,785	(-)1.4
Haryana*	..	69,625	..
Jammu & Kashmir	11,294	13,612	(+)20.5
Karnataka	60,643	48,657	(-)19.8
Kerala	377	310	(-)17.8
Madhya Pradesh	55,517	54,659	(-)1.6
Tamil Nadu	106,452	100,690	(-)5.4
Maharashtra	61,491	65,891	(+)7.1
Nagaland	..	@	..
Orissa	1,100	14,095	(+)1181.4
Punjab*	149,907	66,392	(-) 65.8
Rajasthan	205,633	199,673	(-)2.9
Uttar Pradesh	200,826	196,745	(-)2.0
West Bengal	690	1,306	(+)89.2
Andaman & Nicobar Islands	..	..	..
Chandigarh*	..	156	..
Dadar Nagar Haveli	..	@	..
Delhi	5,663	3,795	(-)33.0
Himachal Pradesh*	2,306	4,625	(+)100.5
Laccadiv Minicoy & Amandiv Islands	..	..	..
Manipur	..	..	..
Pondicherry	..	177	..
Tripura	..	..	..
all India	10,96,259	10,54,350	(-)3.8

*Figures for Punjab, Haryana, Himachal Pradesh and Chandigarh are not comparable due to reorganisation of these States.

@ Included under Mules in Appendix 32.4.

APPENDIX 32.6

(Paragraph 32.2.8)

Per Cent Variation in Population of Horses and Ponies and Donkeys between
1961 and 1966 in Different Districts of Andhra Pradesh

District	Horses and Ponies % variation 1966 over 1961	Donkeys % varia- tion 1966 over 1961
Srikakulam	(+)42.5	(+)13.3
Visakapatnam	(-)26.5	(+)12.9
East Godawari	(-)35.9	(-)43.2
West Godawari	(-)26.8	(-)15.6
Krishna	(-)27.2	(-) 4.5
Guntur	(-)37.1	(-)39.8
Nellore	(-)90.5	(+)13.9
Kurnool	(-)55.0	(-)15.3
Anantpur	(-)60.1	(-) 6.1
Cuddapah	(+)22.4	(+) 3.4
Chittoor	(+)37.8	(-)22.9
Hyderabad	(+) 5.2	(+) 1.8
Mehboob Nagar	(-)33.7	(-)13.7
Adilabad	(-) 1.1	(+)12.6
Nizamabad	(-) 5.6	(-) 5.2
Medak	(+)51.9	(-) 3.5
Karim Nagar	(+)57.1	(+)23.9
Warangal	(-)74.7	(-)79.9
Khammam	(-)69.9	(-) 1.9
Nalgonda	(-)51.8	(-)83.5
Andhra Pradesh	(-)22.0	(-)18.0

Source : Livestock Census of Andhra Pradesh.

APPENDIX 32.7

(Paragraph 32.3.7)

Statewise Distribution of Camels in 1961, 1966 and 1972 in Different States

(thousand)

State/Union Territory	1961	1966	1972	% increase or decrease in 1966 over 1961	% increase or decrease in 1972 over 1966
Andhra Pradesh	a	1	a	..	..
Assam	..	..	..	..	..
Bihar	a	a	a	..	..
Gujarat	44	45	63	(+) 2.27	(+) 40.00
Haryana	*	132	133	..	(+) 0.76
Himachal Pradesh	a	1	1	..	..
Jammu & Kashmir	2	2	3	..	(+) 50.00
Karnataka	1	1	1	..	..
Kerala	..	..	a	..	..
Madhya Pradesh	16	20	14	(+) 25.00	(-) 30.00
Maharashtra	1	2	1	(+) 100.00	(-) 50.00
Manipur	..	..	..	..	..
Meghalaya	..	..	..	..	..
Nagaland	..	..	..	..	..
Orissa	a	..	..	..	..
Punjab	224	119	121	..	(+) 1.68
Rajasthan	570	653	745	(+) 14.56	(+) 14.08
Tamil Nadu	a	a	..	..	..
Tripura	..	..	..	..	..
Uttar Pradesh	43	50	43	(+) 16.28	(-) 14.00
West Bengal	a	a	a	..	..
Andaman & Nicobar Islands	..	..	..	..	..
Chandigarh	*	a	..	..	..
Dadar Nagar Haveli	N.A.	..	..	..	..
Delhi	2	2	1	..	(-) 50.00
Goa, Daman and Diu	..	..	..	..	..
Laccadiv Minicoy & Amandiv Islands	..	..	..	..	..
Mizoram	..	..	..	..	..
Pondicherry	N.A.	..	..	..	..
all India	903	1,028	1,126	(+) 13.84	(+) 9.53

a—Below 500.

*—Comprised part of Punjab.

N.A.—Not available.

MIXED FARMING

1 INTRODUCTION

33.1.1 Mixed farming generally denotes a system of farming combining field crop production with one or more of the enterprises like fruit and vegetable growing; raising cattle, sheep, goats, pigs and poultry as well as fishery, beekeeping, sericulture etc. In mixed farming, the two main components viz., land and livestock act complementary to each other. Crop production provides besides foodgrains, feed and fodder for livestock, while the livestock* provides milk, meat and eggs for the farmer. The growing of leguminous crops in crop rotation improves the soil fertility, helps in soil conservation and thus ensures better land use. The dung, droppings and litters obtained from livestock are useful as manure for building up soil fertility. The nutrients from the soil are taken up by crops to produce grains but only a small portion of these is returned to the soil. Through mixed farming this return can be assured to a larger extent. Thus in the mixed farming system of the land use, farm products and their by-products are better utilised and fetch more income. Also the farm family labour engaged in mixed farming is employed gainfully throughout the year.

33.1.2 The practice of mixed farming not only varies from country to country but also from place to place within a country, depending upon the agroclimatic conditions, size of holdings, availability of inputs and marketing facilities. For example, in the UK the term mixed farming is generally applied to a farm consisting of both grass and arable lands. In Nigeria a mixed farm consists of at least two separate, and not logically inter-dependent parts. It comprises considerable proportion of both permanent grass and arable lands. But the source of manuring the arable land is farmyard manure produced on the farm by cattle fed on grass.

33.1.3 No authentic data about the size of the farm family *vis-a-vis* of land holdings over time intervals during the pre-Independence period

* In this Chapter livestock includes poultry unless otherwise specified.

are easily available. According to the data obtained during the 1970-71 Agricultural Census, about 70 per cent are small farmers possessing land less than two hectares. The average size of holding has, however, decreased, the total number of holdings having gone up. The increase in the number and the decrease in the average size of land holdings are due to a rapid dismemberment of the joint family farming system. The average size of holding¹ in India viz., 2.3 hectare is already very small as compared² to 1841.7 in Australia, 871.3 in Kenya, 231.4 in Newzealand, 187.5 in Canada, 122.5 in USA, 45.2 in UK, 31.7 in Iraq, 18.8 in France, 17.6 in Norway, 17.0 in Denmark³, 14.6 in Sweden, 6.0 in Iran, 5.7 in Malaysia, 5.0 in Turkey and 3.5 ha. in Thailand. However, there are countries with still smaller average land holdings like Egypt 1.6, Japan 1.1 and Indonesia 1.0 ha. In this context subsidiary occupations like raising of livestock in combination with different crops become a necessity for the farmers to make the maximum use of their limited resources and labour capacity in order to supplement their present income.

33.1.4 In Denmark, where the land holdings are not very large, mixed farming with cultivation of arable crops and rearing of dairy and beef cattle, pigs and poultry is practised intensively. Denmark is among the leading exporters of foods of animal origin like butter, cheese, bacon, poultry meat etc. The small farmers utilise most of their time on raising livestock and fodder production. As compared to farmers with large holdings, they find it profitable to concentrate more on livestock rearing in mixed farms. In some of the small holdings more than 90 per cent of the farm income is derived from livestock, cattle contributing nearly a half and pig raising more than one third of the income. A comprehensive well balanced system of mixed farming has undoubtedly been the source of strength, enabling Denmark to compete in the world market.

2 REGIONAL PRACTICES

33.2.1 Mixed farming as traditionally practised in India with combination of crop and livestock production to varying extent provided the farmer in general only a bare sustenance. The emphasis given to agricultural development with the advent of the planning era and

1 Naidu, I.J. 1975. *All-India Report on Agricultural Census, 1970-71*. pp. 25-26. Ministry of Agriculture and Irrigation, Government of India, New Delhi.

2 FAO Production Year Book. 1972.

3 Agricultural Council of Denmark, Copenhagen. 1967. *Agriculture in Denmark*. p. 19. Agricultural Council of Denmark, Copenhagen.

intensive measures introduced during the last decade or so in modernising agriculture have brought about an improvement in crop production as to make it an economically viable occupation excepting the very small holdings. In many parts of the country farmers using modern methods considerably increased investments in grain production. Side by side with developments in crop production there was progress in improving the livestock, particularly through introduction of exotic inheritance in cattle, sheep, pigs and poultry in crossbreeding projects taken up under the Special Development Programmes in 1964-65. For sustaining higher milk production in crossbred cattle greater attention was paid to evolve better fodder varieties and to increase fodder production. Progressively more incentives are being provided through extension of timely and easy credit, setting up of processing plants and organisation of cooperatives. Such integrated development of livestock in selected areas has demonstrated the capacity of livestock raising to increase production and to serve as an effective instrument of social change by bettering the economy of the farmers. The technological developments in crop and livestock production have helped the farmers over large areas in different parts of the country to appreciate the advantages of adoption of combined arable farming and livestock raising for bettering their economic conditions.

33.2.2 Mixed farming in one form or the other is prevalent all over the country. But the practices differ from tract to tract and region to region. In the northern and western regions comprising Punjab, Haryana, Rajasthan, Uttar Pradesh, Gujarat and Maharashtra crop production is combined with livestock raising. Poultry keeping is a common practice around cities where eggs are in demand. In hot arid areas where rainfall is low, and arable farming is a gamble, the rearing of cattle, sheep and goat and camel provides an insurance against drought years. In the central region comprising Madhya Pradesh, Bihar, and parts of Maharashtra and Andhra Pradesh cultivation of cereals, jute, pulses, oil seeds and tobacco are common. Livestock raising is popular, but economically it is not as important as in the northern or north-western zones. In the southern region cereals, oil seeds, pulses are cultivated while livestock raising is fairly common in rural areas. In the north and north-eastern hilly region comprising Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh, Assam, Meghalaya and Nagaland, orchards and cereals are raised combined with sheep and/or pig rearing. Crop production has thus been combined with the raising of one type or the other of livestock in every region of the country, depending upon climate, rainfall, type of soil and other factors. However, the way the mixed farming is being practised by the farmers today, it does not give them the optimum benefit derivable.

33.2.3 Norman C. Wright (1937)¹ while reiterating the recommendation of earlier observers that the development of Indian agriculture urgently required "the dovetailing of the arable and animal husbandries into one mixed farming system"² drew attention to the valuable contribution made by cattle in maintaining the soil fertility. He, however, observed that no specific data on the cash value of cattle dung that goes to the field as manure and part used as fuel, were available. He felt that mixed farming system seemed to be more suitable and would not only involve fuller utilisation of available manure for increasing agricultural production but would also help in maintaining soil fertility through cultivation of leguminous fodder crops. Wright felt that in India mixed farming could be introduced even in irrigated areas and under various climatic and soil conditions. He suggested that to evolve a system of mixed farming suitable to Indian conditions, factors like effect of mixed farming on the yield of cash crops, food crops as well as on the yield and cost of milk production etc. should be studied in detail.

33.2.4 The utility of farmyard manure and the growing of leguminous fodder crops in Indian agriculture was also emphasised by Russel (1937)³. He observed, "a wider introduction of fodder crops into Indian agriculture would probably effect greater improvement in yields and in total output. More food for the animals would mean more manure and enhanced fertility of the soil. This was the prime factor in the improvement of British agriculture and the additional yields of grain more than compensated for the area taken from grain and put into fodder crops. Leguminous fodder crops in addition to increasing the quantity of farmyard manure also enrich the ground on which they grow".

33.2.5 The Famine Inquiry Commission in its final Report (1945)⁴ also agreed with the views expressed by Russel (1937) that solution of India's food and fodder problems was to be found in the adoption of the system of mixed farming. That Commission observed that perhaps the most important, and in many ways the most intractable, of all the rural economic problems is that of under-employment and stressed the adoption of intensive farming as a means of providing employment. They said, "By intensive farming we mean the adoption of all those means of increasing yields; we also include mixed farming under this head. If two or more crops are grown on land

1 Wright, C. 1937. *Report on the Development of the Cattle and Dairy Industries in India*, pp. 53-56.

2 Keen, B.A. 1932. *The Real Problem of India*—Paper read before the Royal Institute of International Affairs, March 1, 1932.

3 Russel, E. J. 1937. *Report on the Work of the Imperial Council of Agricultural Research in Applying Science to Crop Production in India*, p. 42. Imperial Council of Agricultural Research, New Delhi.

4 Famine Inquiry Commission. 1945. *Final Report of the Famine Inquiry Commission*, pp. 183-304. Government Press, Manager of Publications, Delhi.

which at present is cropped only once it is obvious that employment will be substantially increased. A similar result would also be obtained from an extension of the practice of mixed farming which involves greater attention to livestock".

33.2.6 Crop production and the raising of livestock go hand in hand in the farm economy almost in every State but the contribution of various livestock species differs considerably depending upon various factors mentioned earlier. The bullock is the main source of draught power for agricultural operations practically in all States. Sheep raising is popular in hilly areas of Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh and in the plains of Haryana, Rajasthan, Karnataka, Maharashtra and Gujarat. Pig production is quite common in all the north-eastern States and is catching up in Andhra Pradesh, Haryana, Punjab, Uttar Pradesh and West Bengal. Backyard poultry keeping is a common practice with the small farmers and agricultural labourers while commercial poultry farming is practised around big cities and newly developed industrial complexes where poultry products have a ready market.

33.2.7 An interesting observation made in the review of the farm management studies¹ is that the farm family labour and the draught animals remain idle for a substantial part of the year in a number of States as will be evident from the data given in Table 33.1. It will be seen from Table 33.1 that the farm family labour and the livestock (bullock) used for draught power are better utilised in districts like Amritsar and West Godavari where livestock is more productive and irrigation system is well developed. More employment to both human labour and draught animals in these areas may be attributable to mixed farming practice which involves raising of fodder crops for animals and better land use for higher production. Under conditions of optimal mixed farming, bullock power can be profitably utilised for raising additional crops including fodder crops, chaffing fodders and lifting irrigation water from wells in small holdings particularly where canal irrigation is not available. Additional production of fodder will help in improving the quality and production of livestock. Such favourable farming practices, if attempted in other areas, can go a long way not only in utilising the presently idle bullock or/and human labour but also in improving the crop intensity, productivity per unit area and also increasing per capita income. Besides, individual farmers can use the bullock power for land levelling, bunding and soil conservation operations. Thus land that is at present lying waste or fallow can be brought under cultivation.

¹ Ministry of Food and Agriculture, Government of India, New Delhi—*Studies in the Economics of Farm Management*, pp. 195-96. Directorate of Economics and Statistics, Ministry of Food and Agriculture, New Delhi.

33.2.8 The information contained in the studies mentioned above, however, does not help in making even a rough estimate as to the contribution livestock rearing makes to the farmers' economy. Information on the productivity of livestock and the feeding and management practices followed in the different regions is also not available. Such information as is available is not uniform and we are unable to make any satisfactory comparison even between different States. In view of the increasing demand of livestock products such as milk, meat, egg and wool and the importance now being given to livestock production, we consider it necessary that collection of data on livestock rearing practices must be given more attention in farm management studies.

TABLE 33.1

Employment of Farm Family and Draught Animal

Name of the District and State	Year	Employment (days)	
		Farm family ¹	² to ⁶ Livestock
1	2	3	4
Amritsar* (Punjab)	1954-55 to 1956-57	267	129
Hooghly ³ (West Bengal)	1954-55 to 1956-57	79	43
Raipur ⁴ (Madhya Pradesh)	1962-63 to 1964-65	111	65
Sambalpur ⁵ (Orissa)	1957-58 to 1959-60	105	66
West Godavari ⁶ (Andhra Pradesh)	1957-58 to 1959-60	160	70

1 Ministry of Food and Agriculture, Government of India, New Delhi, 1974. *Indian Agriculture in Brief*. 13th edn. Directorate of Economics and Statistics, Ministry of Food and Agriculture, New Delhi.

2 Ministry of Food and Agriculture, Government of India, New Delhi 1957. *Studies in the Economics of Farm Management in Punjab, Combined Report* (1954-55 to 1956-57), p. 35. Directorate of Economics and Statistics, Ministry of Food and Agriculture, New Delhi.

3 Ministry of Food and Agriculture, Government of India, New Delhi. 1957. *Studies in the Economics of Farm Management, Studies in Hooghly (West Bengal), Combined Report* (1954-55 to 1956-57). Directorate of Economics and Statistics, Ministry of Food and Agriculture, New Delhi.

4 Ministry of Food and Agriculture, Government of India, New Delhi. 1965. *Studies in the Economics of Farm Management in Raipur (MP), Combined Report* (1962-63 to 1964-65), p. 58. Directorate of Economics and Statistics, Ministry of Food and Agriculture, New Delhi.

5 Ministry of Food and Agriculture, Government of India, New Delhi. 1958. *Studies in the Economics of Farm Management in Sambalpur (Orissa), Combined Report* (1957-58). Directorate of Economics and Statistics, Ministry of Food and Agriculture, New Delhi.

6 Ministry of Food and Agriculture, Government of India, New Delhi. 1960. *Studies in the Economics of Farm Management Studies in West Godavari (AP), Combined Report* (1957-58—1959-60). Directorate of Economics and Statistics, Ministry of Food and Agriculture, New Delhi.

3 SCOPE FOR LIVESTOCK PRODUCTION IN MIXED FARMING

33.3.1 Livestock rearing has all along remained mainly a rural occupation, practised as complementary to crop production. Most of the small and marginal farmers who practise only arable farming hardly earn enough to get the bare necessities of life. The farm family remains underemployed during most part of the year and is well in a position to take on some subsidiary occupations to supplement its income. Therefore, the rearing of livestock should be encouraged as a suitable subsidiary occupation along with crop production. Livestock raising, as practised at present in most of the rural areas is not remunerative because of low productivity of the stock maintained by the farmers. However, with the introduction of better stock and adoption of improved husbandry practices, as suggested in our Interim Reports on Milk Production through Small and Marginal Farmers and Agricultural Labourers and Poultry, Sheep and Pig Production through Small and Marginal Farmers and Agricultural Labourers for Supplementing their Income (hereinafter referred to as Interim Report on Milk Production and Interim Report on Poultry, Sheep and Pig Production respectively) these occupations could easily be made more remunerative. Improvements in the productivity of livestock apart from improving the availability of livestock products such as milk and milk products, egg and poultry, wool and mutton, pork and pork products offer great potentialities for providing employment to the farm families.

Cattle Raising

33.3.2 It has been suggested in our Interim Report on Milk Production that in augmenting milk production there is good scope for utilising to the maximum extent the facilities already available with the farmers. This applies even to farmers with very small holdings and landless agricultural labourers in rural areas. It is a well-known fact that in spite of the low productivity of milch animals maintained by the farmers, the major proportion of milk produced in the country comes from small producers. This indicates that the farmers have some small capital in the form of milch animals which yield a return through milk production. Two studies^{1,2} carried out by the Sardar Vallabhbhai Vidyapeeth, Gujarat indicate that dairy farming has much potentiality to benefit the rural population and contributes a handsome

1 Amin, R.K. 1964. *Valasan—Socio-Economic Study of a Charotar Village*, pp. 67-68, Department of Economics, Sardar Vallabhbhai Vidyapeeth, Vallabhbhai Vidyanaagar, Gujarat.

2 Vyas, V. S. et al. 1969. *Significance of the New Strategy of Agricultural Development for Small Farmers*.

proportion of the total farm income. Similarly, another enquiry¹ into the economics of dairy enterprises in a selected agricultural tract of Delhi area has shown that the average net return per milch animal per annum is of the order of Rs. 227.6 in holdings of less than 2 ha size. The net return in holdings of 2 to 4 hectares was of the order of Rs. 306 per annum. From the above studies it is manifested that the raising of cattle in mixed farming has considerable potentialities for improving the economic well being of the farmers.

Sheep and Goat Rearing

33.3.3 The surveys conducted by the Institute of Agricultural Research Statistics on the estimation of wool production in different regions of the country have shown that 75 per cent sheep flock-owners in Himachal Pradesh, 43 per cent in Karnataka and 40 per cent in Andhra Pradesh fall under the categories of small farmers and marginal farmers. A large number of flocks are owned by such farmers in the States of Gujarat, Rajasthan, Haryana and Uttar Pradesh. Small and marginal farmers should be induced to take to sheep raising as a subsidiary occupation as part of mixed farming. Sheep are well adapted to different agroclimatic regions excepting areas of heavy rainfall. If sheep rearing and wool production are taken up through a large number of farm families in the rural areas, even though each unit produced a small quantity, there would be sufficient wool to feed the existing cottage industry. Not only would farmers be economically benefited through a ready market but it would also create employment opportunities for the village artisans. Similarly milch goats could be introduced for milk production amongst smaller farmers. Sheep and goats are capable of consuming different kinds of herbage and weeds and live on grazing without much cost on feeding. The lambs and kids can be disposed of as meat animals for quicker returns. Sheep and goat droppings improve soil fertility. The rearing of these animals does not require any large investments except purchasing quality stock and therefore offer good scope in the mixed farming system particularly in the States referred to above.

Pig Production

33.3.4 Pig is a very good converter of farm byproducts and kitchen wastes into edible food. With some supplemental feeding with coarse grains pigs are capable of producing quality pork. At present pig keeping is mainly in the hands of weaker sections of the community

¹ Singh, C.B. 1965. An analysis of feed-milk relationship and cost of production of milk on farms in Delhi area. *Indian J. agric. Econ.*, 20(1).

and the tribals. Pigs maintained by them are mostly local and of nondescript types. Improved pig rearing can, therefore, be made into a profitable subsidiary occupation in those areas where consumption of pork and pork products is common and particularly in areas around bacon factories and near ports. Introduction of improved exotic breeds in tribal areas of north eastern States—Assam, Nagaland, Manipur, Meghalaya, Tripura, Mizoram and Arunachal Pradesh, which have a high density of pig population and where pork consumption is also high would go a long way in ensuring better nutritional standards and economic returns to the farming community. In spite of large pig population in the north eastern States, pigs are imported to meet the local requirements for consumption and breeding from the neighbouring States of West Bengal, Bihar etc. There is, therefore, need for not only increasing the number and improving the quality of pigs kept by the farmers in these States but also encouraging more farmers to take to rearing of improved types of pigs. During the recent past a healthy trend in pig production has been noticed in some States like Andhra Pradesh and Punjab where progressive farmers living around the bacon factories have taken to pig rearing as a mixed farming practice because of attractive economical returns.

Poultry Production

33.3.5 Introduction of poultry keeping as a supplementary occupation will be of great economic value particularly for the small and marginal farmers. The inputs required for keeping small flocks of birds can be made available locally in rural areas. Land and capital investments required for starting poultry units are small. Simple equipment for feeding, watering and shelter for a unit of 25 to 50 birds can be manufactured with locally available materials in the village with the help of local artisans. Interested farmers can be supplied quality stock of different ages from the Government farms or from private poultry farms. A major portion of the feed required could be obtained from home grown grains and farm byproducts. Introduction of backyard poultry raising in the mixed farming system has another important advantage. It provides employment for the women and youngsters of the farm family besides supplementing the income and enriching the family diet. Poultry droppings give very good organic manure, richer than cow dung.

4 APICULTURE, SERICULTURE AND PISCICULTURE IN MIXED FARMING

Apiculture

33.4.1 Beekeeping, apart from producing honey and wax, helps in

enhancing agricultural production. Since bees forage for themselves whenever the weather is suitable for collecting nectar from flowering trees, shrubs, crops etc., the farmer spends nothing on their feeding. The hives and other equipment are simple and can be made by the village artisan. The Khadi and Village Industries Commission has been extending technical and financial assistance to beekeepers in the rural areas but their efforts need to be intensified through intensive extension work. Experiments so far conducted by the State Departments of Agriculture, agricultural universities and the Khadi and Village Industries Commission indicate that the number of bee colonies can be multiplied quickly with great advantage. Requiring very little investment, beekeeping can be adopted as a subsidiary occupation supplementing the farmers' income as suggested in Chapter 27 on Apiculture.

Sericulture

33.4.2 The rearing of silkworm finds a very useful place in the mixed farming system particularly because it provides employment in the lean agricultural season and the leisure periods of women, old and even infirm members of the farm family giving them an additional income. Silkworm pupae have been found to be a source of protein rich feed for poultry and fish. Thus, sericulture has become an additional source of income for silkworm rearers. Karnataka, West Bengal and Jammu & Kashmir located in different climatological regions are important silk producing States. From this it can be assumed that the mulberry cultivation and silkworm rearing can be undertaken almost in every part of the country. Rearing of silkworm and planting of mulberry trees should be tried for extensive adoption as a part of mixed farming wherever possible in other States. Similarly, sericulture can be introduced as a mixed farming practice in the States where castor is grown for seed as suggested in Chapter 26 on Sericulture.

Pisciculture

33.4.3 In certain parts of the country, particularly in the eastern States, there is private ownership of small water holdings as a part of the land holdings. In such areas intensive fish culture, with improved technology should constitute an integral part of mixed farming. The correct cultural practices should comprise adequate stocking of seedfish of composite carps, and economic introduction of requisite manure and artificial feeds. With proper management practices, yields as high as 8,000 kg/ha may be obtained in such small water

holdings. In the swampy areas where high water paddy cultivation is practised, there may be possibilities of undertaking post-paddy fish culture, if the depth of water is adequate in such areas during the remaining period of the year when paddy is not being raised. The particulars regarding intensive fish culture including economics are given in Section 7 of Chapter 37 on Inland Fisheries and Aquaculture.

5 RESULTS OF STUDIES ON MIXED FARMING

33.5.1 The Indian Council of Agricultural Research prepared a scheme for simultaneous investigation and demonstration of mixed farming. This scheme was in operation from 1941—46 with local modifications in four provinces of undivided India, i.e., United Provinces (U.P.), Central Provinces and Berar, North West Frontier Province (NWFP) and Sind. Under this scheme higher crop yields were obtained from all the mixed farming units over the control units as indicated in Table 33.2.

TABLE 33.2

Average Crop Yields (mds. per acre) under Mixed Farming (MF) and Control (C) from 1941—46¹

Crop	Province	Average (1941—46)	Control	Percentage* increase in col. 3 over col. 4
		Mixed farming		
1	2	3	4	5
paddy	(i) U.P.	11.2	8.2	36.6
	(ii) C.P.(r)	13.4	11.7	14.5
wheat	(i) U.P.	14.2	10.8	31.5
	(ii) N.W.F.P.	8.0	7.0	14.3
maize	N.W.F.P.	14.1	9.5	48.4
cotton	C.P.(c)	3.7	3.1	19.3
sugarcane	U.P.	530.0	390.0	36.0
gram	U.P.	9.9	7.4	33.8

1 Finney, D. J. and Panikkar, M. P. 1953. Experimental tests of mixed farming in India. *Indian J. agric. Sci.* 23(4): 269—81

* This column is our calculation
r—rice tract c—cotton
one maund = 37.32 kg

Similarly, mixed farming units gave larger net profits, more income per acre and resulted in higher crop intensity over the control units. Table 33.3 shows that mixed farming was superior to other systems of farming.

TABLE 33.3
Income from Mixed Farming

Province	Net profit (Rs.) per acre		Income per acre (Rs.)		Intensity of cropping (per cent of size of holding)	
	Mixed farming	Control	Mixed farming	Control	Mixed farming	Control
U.P.	111	53	186	110	140	120
N.W.F.P.	143	65	165	79	166	118
C.P.(r)	60	29	93	50	158	134
C.P.(c)	31	21	57	40	98	94

r—rice tract

c—cotton tract

Since the holdings under the above mentioned scheme were demonstration as well as experimental units, only those owned by progressive cultivators (owners or tenants) were selected and given extensive assistance and technical guidance from the Provincial Departments of Agriculture. It was, therefore, difficult to assess whether the larger yields and profits in these experimental units were attributable to mixed farming practices or to extra provision of technical and other inputs. The experts reviewing this work later considered that only a scheme avoiding such special treatment of the units could portray the real economic benefits or utility of mixed farming, if any. The Famine Inquiry Commission (1945) had doubts whether the experiments conducted (between 1941—46) in the four States were on sufficiently large scale. The Commission observed, "the introduction of mixed farming has been strongly advocated by experts well qualified to advise on the subject and it appears to us to be imperative that the possibility of introducing this system should be fully investigated in all provinces. We accordingly recommend that the experiments now being carried out should be continued and extended to other parts of India i.e., Bihar, Bengal, Madras where the difficulties attending the adoption of this system are probably greater than in the areas in which investigations are now being conducted".

33.5.2 The socio-economic study¹ of a Charotar village, Valasan,

1 Amin, R. K. 1964. *Valasan—Socio-Economic Study of a Charotar Village* p. 12, 67—69. Department of Economics, Sardar Vallabhbhai Vidyapeeth, Vallabhbhai Vidyanaagar, Gujarat.

in Kaira District, Gujarat, conducted in 1958-59, revealed that there was scope for development of livestock from the point of view both of good agriculture and good investment. The study revealed that out of the total gross income of Rs. 6,64,000 of the village from agriculture and allied pursuits, milk alone accounted for about Rs. 3,29,000 (approximately 49 per cent); the total value of all other agricultural products, both food crops and non-food crops, was about the same i.e., about Rs. 3,34,000. As a source of the villagers' cash income, milk production had an advantage; the cash income from the sale of milk was about Rs. 2,03,000 in 1958-59 while the sale of all other agricultural products, including foodgrains, gave Rs. 2,02,000. Similarly, in the net income of the village from various sources, milk occupied a very important place and gave a net income, of about Rs. 2,07,000 as against a net income of about Rs. 2,28,000 from all other agricultural activities. The study indicated the enormous scope for the small farmers to develop animal husbandry particularly cattle raising for milk production along with crop raising.

33.5.3 The ICAR carried out some pilot investigations on the economics of specialised dairy farming, mixed farming and arable farming over a period of six years (1962-63 to 1967-68)¹ at Nasirpur, Patiala (Punjab). The investigations were carried out on 15 acres (about 6 hectares) of irrigated and fertile land, 5 acres (about 2 hectares) each for dairy, mixed and arable farming units. These units were each stocked with 10, 5 and 1 high yielding milch Murrah buffalo respectively and a pair of bullocks for cultivation and other agricultural operations. The average annual net return from these units was about Rs. 2,997 from dairy farming, Rs. 2,730 from mixed farming and Rs. 2,243 from arable farming. This worked out to an annual average net return per hectare of Rs. 1,480, Rs. 1,340 and Rs. 1,107 in dairy farming, mixed farming and arable farming units respectively. The net return was calculated after allowing for labour charges paid for farm and stall operations. The average net return per Rs. 100 invested, was Rs. 16.60 in the dairy farming unit, Rs. 16.40 in the mixed farming unit and Rs. 13.30 in the arable farming unit. This investigation showed that dairy farming and mixed farming systems were almost of the same order, indicating better economic returns over arable farming.

33.5.4 The ICAR sanctioned an All-India Coordinated Research Project to determine the economics of milk production under intensive dairy farming conditions in relation to high yielding varieties of cereals and cash crops. The Project started functioning from September,

¹ Raut, K. C. and Chugh, K. K. 1971. Productivity of different systems of farming—Comparative study. *Indian Eng.*, 20 (10) : 37-39.

1970. Under the Project nine Research Centres were to be established at Allahabad, Hyderabad, Jhansi, Midnapur (West Bengal), Poona, Patna, Hissar, Jabalpur and Udaipur. The programme of work at each of these nine centres included three systems of farming viz., (a) specialised dairy farming in two hectare block including intensive fodder cultivation and maintenance of five high yielding dairy animals; (b) mixed farming with two hectare block using 50 per cent of the area for fodder cultivation for three high yielding dairy animals and using the remaining 50 per cent of area for grain/cash crops cultivation; (c) arable farming with two hectare block with 10 per cent of the area being used for fodder cultivation for only one dairy animal and the remaining 90 per cent used for grain/cash crops cultivation. Keeping in view the various agroclimatic factors five centres, viz., Allahabad, Hyderabad, Jhansi, Midnapur and Poona were provided with crossbred animals while three centres viz., Hissar, Jabalpur and Udaipur were provided with buffaloes as dairy animals. From the latest annual report (1973-74) it was observed that as against an investment of Rs. 100 at Poona centre with crossbred animals maximum returns of Rs. 189.32 were obtained from the mixed farming unit. The lowest returns of Rs. 55.89 against Rs. 100 invested were obtained from the specialised dairy farming unit at Jabalpur. The net profit obtained per Rs. 100 invested from the three systems of farming viz., arable farming, mixed farming and specialised dairy farming was Rs. 36.72, Rs. 29.04 and Re. 0.22 respectively. The arable farming and mixed farming were found to be more profitable than specialised dairy farming. The profits accruing from the first two systems of farming were quite close to each other. As far as net cost of milk production is concerned, the arable farming units produced milk with minimum cost of Rs. 1.49 per litre very closely followed by mixed farming—Rs. 1.50 per litre and specialised dairy farming—Rs. 1.65 per litre. Another interesting and significant finding of this project noticed at the Hissar centre was that high yielding buffaloes can be maintained only on fodder based ration without affecting their health and production.

33.5.5 Even though Indian farmers generally practise mixed farming in one form or the other, yet it has not been adopted in full by the Indian peasantry as it should have been. In the main this has been due to, absence of superior livestock with genetic potentials for high productivity, shortage of feed and fodder, lack of knowledge of proper land use and crop rotations among small farmers, difficulties in obtaining easy and timely credit, lack of marketing facilities etc. Thus, mixed farming practices never became as remunerative system of farming, particularly for the small farmers. To improve the lot

of this section of the farming community we feel that the essential inputs of mixed farming in a package as mentioned above will have to be ensured. The combination of all these factors will give the maximum return from a unit.

6 BENEFITS OF MIXED FARMING

33.6.1 The mixed farming system gives the cultivator and his family extra and remunerative employment at their own farm. Under the present system of farming the farm labour and the draught cattle remain idle for most part of the year as indicated in paragraph 33.2.7. The remedy for underemployment in the farming sector lies not only in rationalising arable farming practices but also combining arable farming with animal husbandry, beekeeping, silkworm rearing and fishery as profitable supplementaries. Most of the idle time of the farmer's family will be gainfully utilised on subsidiary occupations like the rearing of cattle, poultry, sheep, pigs, silkworm, fish and beekeeping, harvesting hay for feeding livestock and marketing of the produce. The more satisfactory position regarding farm family employment in Andhra Pradesh, Haryana and Punjab can be partly attributed to the invariable practice among farmers in these States of keeping one or more good milch animal. The demoralising influence of idleness on the farm family is thus avoided to a great extent.

33.6.2 Ibne Ali (1950)¹ observed that a pair of bullocks/cows gave 25 cart loads of manure which was considered sufficient to provide humus and a large part of the fertilising elements for a unit of four acres (1.67 hectares) of wheat or paddy, and that for two cows one acre (0.4 hectare) of land was necessary for growing green fodder jowar in *kharif* and *berseem* in *rabi*. Manure obtained from these animals may help in increasing yield of crops in four acres (1.67 hectares) to almost equivalent of six-seven acres (2.45—2.86 hectares) of unmanured land. In mixed farming system, the availability of manure is automatically assured and this reduces the necessity of keeping the land fallow to recoup its productivity. Under arable farming this convenience of availability of farmyard manure is denied to a great extent. If leguminous fodders are grown in rotation with other crops, it helps further to augment soil fertility. Mixed farming system helps to put land to maximum use. All the byproducts of crop production such as *bhusa*, paddy straw, sugarcane tops, vegetable leaves etc., which cannot be otherwise profitably disposed of

¹ Ibne Ali. 1950. Mixed farming in Uttar Pradesh, *Indian Fmg.*, 11 : 325-27.

are best utilised for feeding animals. This will result in enhanced production of animal products like milk, eggs, meat etc. and give the farm family better nutrition. Thus, under the mixed farming system the essential nutrients in the dietary of the farm family could be met from the farm unit itself.

33.6.3 Under mixed farming system the farm family gets a regular flow of the farm income round the year particularly from the milch stock maintained at the farm. This continuous flow not only helps to meet various day to day cash requirements of the farm family but also saves farmers from indebtedness during pre-harvest seasons. Kaira District Cooperative Milk Producers' Union (Gujarat) is the best example where to a regular flow of income to the farmer through the sale of milk has revolutionised the social life of the farmer members in the villages served by this Union.

33.6.4 About 30 years ago the pattern of farming and life of the farmers in Kaira district were the same as in many other parts of the country. Even though, some type of mixed farming was in vogue, the farmers depended mainly upon grain crops, as the income from their milch buffalo was meagre and undependable. There were no proper marketing facilities for milk and milk products organised by Government agencies or cooperatives. The farmers had to depend entirely upon a private creamery and on the contractors and the middlemen who fully exploited the situation. The farmers had, therefore, to sell their produce at very low prices. The development of marketing facilities of lifting milk from every village mainly contributed to the growth and success of the Kaira District Cooperative Milk Producers' Union and has encouraged the farmers to take to better animal husbandry practices for increased milk production. The productive capacity and the reproductive efficiency of the milch buffaloes have been considerably improved with the result that the income of the farmers covered by the Union is much more than the rest. Farmers have also felt encouraged to grow forage crops increasing milk production and minimising the cost of milk production. In Kaira district where lucerne (*Medicago sativa*, L.) was non-existent on any sizeable scale before, over 40,000 farmers are now growing lucerne for fodder. An ideal combination of land use for food or cash crops, fodder and milk production has been developed to progressively improve the prosperity of these villages. It can thus be concluded that the rearing of good quality milch animals as a subsidiary occupation along with arable farming, if adopted with application of modern technology and provision of marketing facilities would bring a better life to the farming community.

33.6.5 During the visits to the different States the Commission

elicited the views of farmers, agricultural scientists, officials and non-official leaders in the States about the policy matters on the advisability of adopting mixed farming in agriculture. Earlier the Commission had sent a questionnaire listing important policy issues to the states for circulation to concerned persons. This was done to facilitate discussions and to have the benefit of the latest thinking of the participants in the subsequent meetings. Through the replies received in response to the questionnaire and during discussions in different States we were given the impression that mixed farming was considered by every body as the most desirable system of farming under the varying conditions prevailing in different parts of the country. However, in Haryana State we were informed that in some areas there is a strong prejudice against pig raising and fish culture in mixed farming. With proper propaganda and education programmes it should not be difficult to remove such prejudices among the farming community.

Need for Further Studies

33.6.6 Since a vast majority of the farmers are practising mixed farming in one form or the other, it is necessary to carry out investigations in detail with special reference to the possible contribution the rearing of dairy animals, sheep, goats, pigs and poultry can make to the economics of farming under Indian conditions. Potentialities of sericulture and apiculture should also be studied in this context. In most of the studies/investigations carried out in the past results have not been entirely free from bias and ambiguity. We, therefore, consider it necessary that detailed studies should be taken up in various agroclimatic regions of the country for determining (a) the minimum economic unit and type of the livestock for each unit of holding for a specific regional situation; (b) the increase in income in a mixed farm that is attributable to livestock and other component; and (c) the extent of utilisation of potential farm family labour and farm livestock. In these studies agroclimatic regions may be further divided into dry land and irrigated farming areas separately. This type of division will help in drawing up more realistic programmes for carrying out investigations. Care has to be taken that all the aspects and combinations of agricultural practices such as growing of grain, cash and vegetable crops, the growing of fruit trees or orchards, tea and coffee plantations, the rearing of cattle for milk and drought, sheep for mutton and wool, goat for milk and meat, pigs for pork and poultry for eggs and meat, the rearing of silkworms for silk, bee-keeping for honey and wax production and fish for food are covered

for the benefit of the farmers in different regions. It would be advisable to have mixed farming units of one hectare, two hectares and five hectares each including different sizes of livestock and other components. When satisfactory data are obtained and definite conclusions arrived at as to the most suitable combinations for different situations, the ICAR should organise a large number of demonstrations on mixed farming on the lines of other National Demonstration Projects in crop production.

Importance of Animal Husbandry in Special Areas

33.6.7 There are certain areas in the country where crop raising alone cannot provide sufficient income for the economic well-being of the farmers due to frequent natural calamities like drought, floods etc. These areas offer opportunities for raising livestock and, therefore, livestock rearing should invariably be encouraged. Such situations exist in the arid zones, drought prone areas and in the hills particularly at high ranges. In these areas, as irrigation facilities are highly inadequate, cultivation is restricted to periods of rainfall and thus livestock raising gives opportunities for off season utilisation of family labour. We have already recommended in our Interim Report on Desert Development that in the areas commanded by the Rajasthan Canal and the proposed additional lift canals, cattle breeding for milk production should be encouraged and that a mixed farming pattern of agriculture should be popularised. Cropping patterns to be recommended should be suitable for this type of farming and should include growing of fodder crops in about 30 per cent of the irrigated areas to ensure a good supply of green fodder for high yielding cattle. In that Report we had also pointed out the scope for taking up improved sheep rearing along with crop production through some of the farmers in the eastern districts of Rajasthan such as Churu, Nagore etc. It is recommended that farmers should be encouraged to earmark some area as pasture for sheep and that they should be provided financial assistance for undertaking land development, use of fertilisers and re-seeding their grasslands.

33.6.8 In the high ranges of Kerala State the experience from the working of the Indo-Swiss Project has shown that improvement of cattle mostly owned by small farmers, through crossbreeding for higher milk production could go a long way in augmenting the income of the farmers in these areas. Efforts are also being made for improvement of grasslands in this region for ensuring better forage for cattle. Similar experience has also been gained in the areas covered by the Indo-German Project in Mandi (Himachal Pradesh) and in

Almora District (Uttar Pradesh). In the high altitude areas of the western Himalayan region encouragement should be given for rearing small stationary sheep flocks in the apple orchards in Himachal Pradesh and Jammu and Kashmir. Limited experience gathered so far has shown that legume grass mixture could be grown in the orchards for the maintenance of sheep. The Jammu and Kashmir Government have already taken up a programme for sheep rearing as a supplementary occupation by farmers having small orchards. Pork consumption is quite popular in the tribal areas and in the eastern Himalayan region. In the latter improvement in the quality of pigs has already been made to some extent. We have emphasized the role which piggery development could play in improving the economy of the small and marginal farmers and agricultural labourers in our Interim Report referred to earlier. The programmes suggested by us envisage improvement in the quality of pigs through better breeding methods and linking up production with suitable marketing avenues. A number of districts having large indigenous pig population in the tribal areas and hilly areas have been identified for piggery development programmes. The programme should be implemented on a priority basis to integrate pig rearing as a mixed farming practice by a large number of farmers in these districts. So far as poultry raising is concerned this could be introduced in all the areas of the country. In all areas having good scope for marketing eggs and poultry, the keeping of birds on backyard farming basis and in smaller units and in deep litter system should be popularised as a mixed farming venture. Keeping in view the role played by animal husbandry in the development of special areas, we are of the opinion that mixed farming is the most suitable system of farming and needs popularisation. We have pointed out in Chapters 26 and 27 on Sericulture and Apiculture respectively in detail the scope that exists in different parts of the country as far as silkworm rearing and bee-keeping are concerned.

Local Employment Potential

33.6.9 It has been estimated that the small and marginal farmers constitute about 52% of the total rural households. In order to make a dent into the rural poverty and to extend the benefit of planned development to the small cultivator and underprivileged section of the rural population, special programmes particularly suited to these classes of people have recently been launched by the Government of India. These programmes are popularly known as Small Farmers Development Agency (SFDA) and Marginal Farmers and Agricultural

Labourers (MFAL) projects. Under these projects crop production no doubt will receive major emphasis. The possibilities of supplementing small farmers' income and utilisation of farm family labour more profitably, which otherwise might have remained partially or wholly idle, through subsidiary occupations like the rearing of cattle, sheep, pigs and the raising of poultry should receive special attention. In our Interim Reports on Milk Production and Poultry, Sheep and Pig Production we have emphasised the need for introduction of improved types of livestock along with ensuring proper and remunerative marketing outlets. Therefore the livestock production enhancement programmes in the country should be concentrated on encouraging a mixed farming system which would *inter alia* help in the improvement of the economic lot of the small farmers.

Inclusion of Fodders in Crop Rotations

33.6.10 The conventional pattern of farming has been the raising of crops during the main crop seasons. The period between the two main seasons is seldom utilised for a catch crop due to paucity of irrigation and non-availability of short duration varieties. But in recent years with the improvement of irrigation, development of numerous varieties, strong and efficient extension methods, systems of multiple and relay cropping patterns have been introduced in suitable areas. These should enable making judicious combinations for the production of cereal, cash and fodder crops. Fodder crops hardly find a place in the usual crop rotations. Through adoption of better rotations not only crop intensity and the produce per unit area are increased but a balanced food for the farm family and nutritious fodder for the farm stock are assured without much extra investment. In relay cropping leguminous fodder crops and crops of shorter duration can be taken as catch or companion crops. For example, oats, peas, mustard, turnips, etc. can be sown as *zaid kharif* fodder crops and cowpeas, *jowar* etc. can be sown as *zaid rabi* crops. The sowing of fodder crop in between the two main crops would enable fuller utilisation of residual moisture and nutrients by the following crop in addition to controlling the weeds and soil erosion. Fodder crops in crop rotations specially in irrigated areas to supplement the straw and hay should be included in any mixed farming system recommended to the farmers for adoption.

33.6.11 In dry areas where irrigation facilities are lacking the marginal farmers are unable to spare any part of their holdings to the cultivation of fodder. Therefore the scope of green fodder pro-

duction under rainfed areas particularly by this category of farming community is very much limited. The straw and *kadbi* produced on the farm as byproducts are also not sufficient to sustain the cattle throughout the year. We are of the view that in such areas the common grassland may be allotted to village panchayats for growing grass and harvesting the same at its proper stage and conserve some of it as hay during the favourable years. These panchayats may also arrange to obtain grass from the nearby forest areas on payment. Hay making in such areas can go a long way in meeting the fodder shortage during recurrent drought years. Another alternative to overcome the fodder shortage is to plant fodder trees on bunds in waste lands and grasslands. The most popular fodder trees are babul (*Acacia arabica*), shisham (*Dalbergia sissoo*), imli (*Tamarindus indica*), pipal (*Ficus religiosa* L), neem (*Azadirachta indica*), ber (*Zizyphus Sp.*), khejri (*Prosopis juliflora*) and mulberry. If grasses from forest areas and other grasslands are conserved as hay and more fodder trees are planted as suggested in our Interim Report on Desert Development and Chapter 25 on Fodder Crops, the problem of fodder shortage can be overcome to a great extent. With regard to other categories of farmers a part of their holdings can be devoted to the production of green fodder wherever feasible. Where common grasslands are not available the marginal farmers and agricultural labourers may be encouraged to go in for poultry and pig rearing.

Quality of Livestock in Mixed Farming

33.6.12 The livestock maintained by farmers practising mixed farming should be efficient converters of fodders and feed to milk, mutton, wool, eggs etc. and utilise them better for body growth. Otherwise, the raising of fodders in place of other crops would prove uneconomical. Keeping this aspect in view we had recommended in our Interim Reports on Livestock production through small and marginal farmers and agricultural labourers mentioned in paragraph 33.6.9 that the farmers should be helped to produce good quality livestock on their own or supplied with high yielding livestock.

Marketing Facilities

33.6.13 In any programme for increased and diversified production efficient marketing is the key to maximum returns from the produce. This is equally applicable to the mixed farming system. Mixed farm-

ing alone cannot help to raise the standard of living of farmers unless it is backed by marketing facilities. All the surplus edible livestock products, fish and vegetables being perishable need immediate disposal. With a view to eliminating the middlemen from taking away the major share of the profit, suitable marketing channels should be created for the produce. Since majority of the farmers practise mixed farming and fall in the category of small and marginal farmers, this could be attempted through the primary village cooperatives or through the farmers service societies or dairy—sheep—pig—poultry societies or other societies already engaged in the supply of inputs like seeds, fertilisers, credit etc. These organisations could lift the farmers' produce and in return besides selling the products, perform the very useful service of supplying them with the inputs required by them.

7 SUMMARY OF RECOMMENDATIONS

33.7.1 The following is a summary of the important recommendations made in this chapter.

1. In order to make year round use of resources and labour potentials of the farm family and the livestock, subsidiary occupations like the raising of livestock, the rearing of fish and silkworm and beekeeping should be organised amongst the farmers.

(Paragraph 33.1.3)

2. The farm management studies should also include details like types of livestock, their feeding and management practices so as to provide data for comparative studies.

(Paragraph 33.2.8)

3. In order to reap the full benefits of mixed farming and to improve the lot of the farming community, the essential inputs should be provided on a package basis.

(Paragraph 33.5.5)

4. Well planned investigations on the advantages of the practices and economics of mixed farming should be undertaken in different agroclimatic regions.

(Paragraph 33.6.6)

5. The ICAR should organise demonstrations on mixed farming practices on the lines of other National Demonstration Projects.

(Paragraph 33.6.6)

6. Livestock raising should be encouraged as a mixed farming practice particularly in areas prone to drought and floods, and in areas

having inadequate irrigation facilities.

(Paragraph 33.6.7)

7. In high ranges of Kerala and hilly regions of Himachal Pradesh and Uttar Pradesh, improvement of milch cattle through crossbreeding should be organised for augmenting farmers' income. The rearing of high quality small-sized stationary sheep flocks should be encouraged in the apple orchards of Himachal Pradesh and Jammu and Kashmir.

(Paragraph 33.6.8)

8. The SFDA/MFAL projects while emphasising crop production should at the same time pay attention to the rearing of improved livestock to enable farmers to supplement their income.

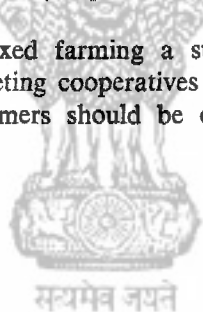
(Paragraph 33.6.9)

9. The livestock maintained by the farmers practising mixed farming should be efficient converters of feeds and fodders; the farmers should be helped to produce superior livestock on their own or supplied with high yielding types of livestock.

(Paragraph 33.6.12)

10. To promote mixed farming a suitable marketing channel between the village marketing cooperatives or the agricultural marketing societies and the farmers should be organised.

(Paragraph 33.6.13)



LIVESTOCK FEEDING

1. INTRODUCTION

34.1.1 Quantitative and qualitative insufficiency of feeds and fodder in the country is one of the main impediments in the way of improvement of livestock production. According to the joint memorandum prepared by the Nutrition Advisory Committee of the Indian Council of Medical Research and the Animal Nutrition Committee of the Indian Council of Agricultural Research¹ (ICAR) an additional quantity of 26.5 million tons of concentrates, 60 million tons of roughages and 178 million tons of green fodder was required in 1951 to provide balanced nutrition to the livestock* population. Based on 1956 livestock census, the Central Council of Gosamvardhana (CCG) estimated that there was a shortage of about 25 million tons of concentrates, 26 million tons of roughages and 258 million tons of green fodder. This according to a study² roughly works out to a deficiency of about 60 per cent of proteins and about 47 per cent of energy. The chronic shortage of feeds and fodder has in general lowered the productive capacity and fertility of the Indian livestock and has brought about their degeneration.

34.1.2 One of the main factors responsible for the overall deficiency of feedstuffs is the enormous population of livestock in the country. At present, land has to provide sustenance for over 600 million human beings and has, in addition, to maintain huge number of animals of low productivity. This results in a tremendous pressure upon the soil and sets in a vicious chain of reactions. Because of low productive capacity of livestock larger numbers of them have to be maintained, which in turn creates greater shortage of feeds and fodder, resulting in further degeneration of the stock. The working efficiency

¹ *Human Nutrition vis a vis Animal Nutrition in India*, 1954, p. 23-24. Indian Council of Agricultural Research, New Delhi.

* In this chapter, livestock includes poultry unless otherwise specified.

² Dhanda, M. R. 1964. The Veterinary profession in retrospect and prospect. *Indian Vet. Journal* 41 : 31.

of indigenous bullocks can be enhanced by 30 per cent¹ and the milk yield of indigenous cows by 50 per cent² by better and scientific feeding.

34.1.3 Extensive programmes of livestock development have been launched in the country with a view to improving the productive capacity of the indigenous livestock. Since the improved animals with higher productivity need better nutrition, there is an imperative need to reduce the number of unproductive stock and to augment the feed and fodder resources. The Famine Inquiry Commission (1945) had rightly stressed that "feeding was of crucial importance, for no lasting improvement could be brought about by breeding alone, since improved breeds deteriorate rapidly if not fed adequately". The steps necessary to improve the productive capacity of cattle and buffaloes, sheep and goats, poultry and other livestock have been dealt within Chapters 28, 30, 31 and 32 respectively. In this Chapter we discuss ways and means to increase the supply of feeds and fodders and to ensure efficient utilization of available feedstuffs in the light of the present position.

Present Status of Livestock Feeding

34.1.4 Several studies have been made to estimate the availability of livestock feeds in India. These have been referred to in detail in Section 3. These estimates, however, differ having been based on different assumptions. Nevertheless, all these studies indicate unequivocally that the feeds available in India are far too short of the requirements for the existing population even at their present low level of feed consumption. Feed resources must, therefore, be greatly enhanced for increased production of milk, meat, eggs, wool etc. as well as to properly maintain the efficiency of draught animals. In agriculturally advanced countries a sizeable proportion of the total arable land is utilised for growing feeds (including grains) and fodders for animals. Quality fodders and grains are routed through animals for the production of meat, milk, eggs, wool etc. However, in India land utilised for growing fodder is proportionately negligible. Besides, owing to seasonal rainfall, availability of green grasses and fodder crops is restricted to only 3-4 months in a year. In some parts of the country irrigated lands have been used to a small extent to grow fodder crops but the extra acreage thus utilised is negligible in proportion to the requirement. The result is that for a major part of the year animals,

1 First Five Year Plan. Planning Commission, Government of India, New Delhi, 1951.

2 Final Report of the Indian Council of Agricultural Research Scheme for Introduction of Balanced Rations for Ryots Cattle for the period 1st April, 1951 to 1st June, 1953. Indian Council of Agricultural Research, New Delhi.

particularly cattle and buffaloes, have to subsist on coarse fodders of low nutritive value which, for milch and working animals only, are supplemented with small quantities of concentrates. The rest of the bovine population are left to fend for themselves on whatever they can get from scanty grazing. Such semi-starved animals can never become fully productive even when deficiencies are made up during production periods.

34.1.5 Animal husbandry in India has made several adjustments to suit seasonal availability of grasses. The indigenous livestock have low rates of growth and production and can thus survive short periods of underfeeding and semi-starvation. They have become seasonal breeders so that the period of maximum feed demand for the calf and the mother occurs when grazing is good. Another adjustment is by migration of herds and flocks, particularly in the drought-prone and desert areas and in the hills to places where more grazing is available. However, for high yielding animals meant for commercial production there is no other way but to supplement grazing with concentrates and fodder crops. To make animals more useful, ways and means have to be found to feed them properly throughout their growing and productive life. This is particularly the case with the improved strains/breeds of animals that are now being produced in increasing number as a result of various livestock development programmes.

34.1.6 The reasons for the shortage of feeds and fodder are many. Area under fodder is very small due to greater need and profitability of land used for cereals, fibre and cash crops. The fodder production per unit area of land for a large part of the year and in certain years is very low due to adverse climatic conditions. Besides, the low industrial base reduces the availability of byproduct feeds. Considerable loss occurs in monsoon grasses because they are not harvested when they have the optimum nutritive value. This may be for want of time, equipment or even manpower. Delayed maturity and poor rate of reproduction of livestock further force the stock owners to increase the number of unproductive follower stock, thereby making the problem of feed shortage more acute. With the availability of better animals, a much smaller number of livestock will be able to produce as much, if not more, food, fibre or work for human use. In certain areas especially of high rainfall, soils are leached out of essential nutrients leading to their deficiency in feeds and fodders. In some areas toxic elements like flouride, selenium, molybdenum etc. may cause health hazard to the animals. Identification of such regions and rectification of deficiency or toxicity in feeds and fodders may open up newer areas where livestock can be gainfully raised.

34.1.7 Many programmes are being taken up for improvement in the productivity of livestock through crossbreeding, grading up and selective breeding. Progressively, the number of animals with high productivity will increase. Such animals cannot be expected to fully express their genetic potential and produce the expected quantities of milk, meat, eggs etc. unless they are fed adequately on feeds and fodders of high nutritive value. We would like to stress that better breeding is no substitute for better feeding. It is expected that the economics of livestock production will improve in the future and investment on land, labour and capital for the production of feeds of high nutritive value, in competition with other uses of these inputs, will be advantageous to the animal owners.

2 FEED REQUIREMENTS FOR LIVESTOCK

34.2.1 Cattle and buffaloes : Feed requirements of nondescript cattle differ considerably from the improved indigenous and exotic cattle. The number of the latter are at present only about 1 million. The population of the crossbred and improved animals will, however, progressively increase as discussed in Chapter 28 on Cattle and Buffaloes. Different feeding schedules have been adopted for calculating the feed requirements of the indigenous and improved animals. For the feeding of indigenous animals, the requirements worked out by Amble¹ (1965) and for higher production the schedules² drawn up on the basis of nutrient requirements given by the National Research Council, (NRC) USA, 1971 have been adopted since the data now available indicate that the animals should be fed according to these requirements. On the basis of the work³ conducted at the Indian Veterinary Research Institute (IVRI), general schedules have been worked out for the rearing of calves economically. According to feeding schedules for different categories of cattle and buffaloes of different age groups, growing bull calves, heifers, lactating, dry and pregnant cows the requirement for bovines for 1973 work out to 17, 343 and 338 million tonnes of concentrates, green forages and dry fodder respectively. For 2000 AD the requirement will be 58.8, 590 and 358 million tonnes of concentrates, green forages and dry fodders respectively.

1 Amble, V.N., Murty, V. V., Sathe, K.V., and Goel, B.B.P.S. 1965, Milk production of bovines in India and their feed availability. *Indian Journal of Veterinary Science and Animal Husbandry* 35 : 221—33.

2 Nutrient requirements of domestic animals, 1971, National Research Council, National Academy of Sciences, USA.

3 Ranjhan, S.K., Feeding of cattle, sheep, goats, 1974, Animal Nutrition Division, Indian Veterinary Research Institute, Izatnagar, Uttar Pradesh, India.

34.2.2 Poultry : Unlike ruminants, the feeding of poultry is complicated. In case of ruminants, the major part of the nutrients comes from roughages that are much higher in crude fibre than the common concentrates fed to the poultry. The protein quality in the dietary of these single stomached animals is very important. Further, under field conditions a poultry ration may be deficient in vitamins A, D, B₁₂ and riboflavin. It may also be necessary to supplement the ration with additional quantities of minerals containing calcium, phosphorus, manganese etc. When the total protein of the mashes is made up by protein-rich oilcakes along with cereals, the amino acids most essential for growth and egg production may be lacking, unless a certain percentage of animal protein is also incorporated. Generally, amino acids like leucine, tryptophane, lysine and methionine have been found to be the limiting factors and may be taken care of by adding 5 to 10 per cent of fish, blood or meatmeal, skimmed milk powder etc. In some countries poultry feeds of plant origin are now being enriched with synthetic lysine and methionine. This procedure if adopted in India will help to reduce to a large extent the use of costly fish or meatmeals. Mashes for poultry may be formulated for different regions according to the availability of ingredients.

34.2.3 In general, NRC standards¹ have been taken for calculating the requirements for starters, growers and layers as well as for broilers. However, in the case of layer strains feeds with higher fibre content have been taken in order to reduce cost of rearing.

34.2.4 Based on feeding schedules in Appendix 34.1 the requirements of different feeds for the year 1973 and 2000 AD have been worked out for only the improved birds. The amount of concentrate required for 36 million of improved poultry works out to 1.260 million tonnes in 1973 and for improved 137 million birds it works to 8.06 million tonnes in 2000 AD as given in Chapter 31 on Poultry. It is assumed that *desi* birds will continue to be maintained without any substantial feed supplement.

34.2.5 Pigs : The feeding of commercial pigs is as complicated as that of poultry. In addition to being balanced for major nutrients their diet should provide adequate amounts of essential amino acids, vitamins, essential fatty acids like arachidonic and linoleic and all essential mineral elements. In countries advanced in pig industry, the pigs are fed mainly on high energy cereal grains. The other feeds for compounding pig rations are so selected that they meet the deficiencies of essential nutrients inherent in grains, namely, proteins of high biological value, vitamins and minerals. For calculating the

¹ Nutrient requirements of domestic animals, 1971. National Research Council, National Academy of Sciences, USA.

feed requirements for 1973 and 2000 AD the NRC recommendations (1971)¹ for the nutrient requirements of different categories of pigs have been adopted.

34.2.6 The nondescript pigs are mostly kept as scavengers on kitchen waste and night soil with little supplement during the finishing period. For scientific pig raising different pig rations have to be given for suckling, growing and finishing pigs. Both for exotic purebred and crossbred pigs which are now being introduced in increasing numbers, the practice of creep feeding has to be intensively used during the suckling period. Exotic pigs have much higher rates of growth and reproduction. The litter is large and the mothers cannot provide adequate nutrition to the young to support their higher rate of growth. A good creep mixture should contain 20 to 22 per cent protein, be low in fibre and should have high palatability. It should be made available to the piglets as early as possible or when they are 10 days old. According to one estimate the feed requirements for the year 1973² of concentrate mixture for 0.32 million improved pigs are 0.22 million tonnes and for projected population of 8.5 million improved pigs in 2000 AD are 4.65 million tonnes of concentrates and 3.1 million tonnes of green fodder. No provision of extra feed has been made for the nondescript pigs which may be left to fend for themselves because scientific feeding will not be economical in their case.

34.2.7 Sheep : Because of their ability to graze close to the roots of the herbage, sheep are very efficient grazing animals. In most of the countries they are maintained on grazing without any allowance of concentrate, except for fattening lambs before slaughter. The grazing lands should be maintained in good productivity to yield year-round adequate nutritious forages or the sheep should be constantly moved to fresh pastures. Wool production is generally not economical if stall feeding has to be depended upon. Pastures and grazing lands which provide a mixed type of herbage containing both leguminous and nonleguminous forages and grasses are suitable for optimum production of wool. An adult sheep consumes daily 3.0 to 3.5 per cent of its body weight in terms of dry herbage. The inferior quality of pastures may fill up the belly but will not provide adequate nutrition. It has been found that at 10 per cent protein level in the daily ration wool production would be optimum. Both fibre length and fibre thickness are affected markedly according to the extent of protein shortage. Sheep suffer from deficiency of trace elements like iodine, copper and cobalt specially on a poor quality roughage ration

1 Nutrient requirements of domestic animals, 1971. National Research Council, National Academy of Sciences, USA.

2 Report of the Committee on Livestock Feeds & Fodders, 1974. Ministry of Agriculture and Irrigation, New Delhi.

without any concentrate allowance. An all roughage ration may, therefore, be supplemented with trace elements either as mixture or in the form of licks.

34.2.8 For calculating the total concentrate feed requirements of the livestock, practically no allowance has been made for sheep as they are expected to obtain their full requirements from grazing alone. However, it will be desirable to make some provision for creep feeding for the very young lambs during the preruminant growth. Also, some provision should be made for supplemental feeding to improved strains of sheep during periods of scanty grazing. With the inclusion of the above, the total requirements in 1973 for concentrate and dry fodder for sheep have been estimated to be 0.3 million tonnes and 3.0 million tonnes respectively. On the same basis we have estimated the requirements for 60 million improved sheep in 2000 AD to be 6.57 million tonnes of concentrates and 8.8 million tonnes of dry fodder.

34.2.9 Goats : Very little information is available on feeding and nutrient requirement of indigenous goats. Goats are prolific breeders. Due to this reason even with high rate of slaughter the goat population increased to over 68 million in 1972 from about 60 million in 1961. Goats, like sheep, consume dry matter at the rate of 3.0 to 3.5 per cent of their body weight daily. Goats for milk production are maintained under ordinary feeding conditions. During gestation period, does require special care and feeding because many breeds bear twins and even triplets. Under-feeding may lead to ketosis (pregnancy toxæmia) at the time of kidding or a little earlier. An extra allowance of 300—500 g of concentrate mixture during the last one-third period of pregnancy i.e. about 2 months should be given to prevent this metabolic disorder.

34.2.10 The kids to be raised for meat production should be given extra concentrate rations for early fattening. Unlike lambs, weaning of kids is easier and they can be reared on substitutes with limited milk feeding like dairy calves.

34.2.11 It is difficult to calculate the feed requirements of goats with reasonable accuracy. At present goats are being maintained on grazing and browsing. Some supplemental feeding will, however, be desirable. For this purpose 4.5 million tonnes of dry fodder and 0.45 million tonnes of concentrates have been shown as requirement in 1973 in Appendix 34.2. In 2000 AD the requirement for 40 million improved goats will be 5.8 million tonnes of dry fodder and 4.38 million tonnes of concentrates.

34.2.12 Horses, donkeys and camels : Very little experimental data are available for ascertaining the feed requirements of equines and

camels in India, except for the race and army/police horses. The number of such horses is very small. Horses and camels in the urban and rural areas are generally engaged in hard, medium and light work during different periods. Horses and ponies (0.99 million) are generally fed with green grasses or hay with a little concentrate, while donkeys are allowed to graze on the ranges. They are fed only rarely with green and dry fodders and grasses but with little or no concentrate. It is estimated¹ that the requirements for horses in 1973 were 0.22 million tonnes of concentrates and 2.0 million tonnes of dry fodder. In 2000 AD their requirement will increase to 0.15 million tonnes of concentrates (Table 34.1). Camels on the other hand are maintained on tree leaves, green and dry fodders including straws with some concentrates. However, there is great need for conducting further experiments to determine the optimum feeding level under different physiological conditions for these species. No allowance has been made for camels and donkeys in the calculations of feed and fodder requirements for 1973 (Appendix 34.2). However, for 2000 AD we have provided 0.18 million tonnes of concentrates for supplemental feeding to camels—Table 34.1.

34.2.13 Total feed requirements in 1973 and 2000 AD : The estimated requirement for concentrate feeds dry and green fodder required in addition to grazing have been given in Appendix 34.2 for the projected population of livestock in 1973 and in Table 34.1 for the projected livestock population in 2000 AD. It may be mentioned that these calculations of feeds are based on NRC nutrient requirements and the requirements worked out in India. Some changes have been made in the feed requirements at these two points of time in view of the expected differences in rates of growth, production and reproduction in the livestock populations. We are of the view that ICAR should strengthen the studies for determining the requirements of different nutrients for production of work, meat, milk, eggs and wool. These studies should be updated every five years and compiled on the pattern of the USDA publication on this subject so as to give guidelines for scientific and economic feeding of livestock. This will also be helpful in arriving at reliable estimates of feed and fodder requirements for optimum production in intensive livestock production areas, milkshed districts and States as a whole for purposes of planning.

34.2.14 Requirements of coarse cereal grains : On the basis of concentrate feeds required for livestock feeding as given in Appendix 34.2 for 1973 and 2000 AD the requirements of coarse cereal food-grains have been estimated at these two points of time. The assumption

¹ Report of the Committee of Animal Feeds & Fodders, 1974, Ministry of Agriculture and Irrigation, New Delhi.

made is that whereas pigs and poultry rations should contain upto 50 per cent of coarse cereals the rations for other livestock should contain on the average 25 per cent of coarse cereals.

34.2.15 On the basis of the Table 34.2 the requirements of coarse cereal grains work out to 5.47 million tonnes in 1973 and 23.9 million tonnes in 2000 AD.

TABLE 34.1

Requirements¹ of Feeds and Fodders for Productive Livestock in 2000 AD*

Category of livestock	Projected population (million)	Requirement per day			Requirement for projected population per year		
		Kg					
		Concentrates	Green fodder	Dry fodder	Concentrates	Green fodder	Dry fodder
cattle							
males working and breeding	73.04	0.25	5.00	5.5	6.66	133.3	146.7
females milch and dry							
non-descript	21.35	0.20	5.00	4.0	1.56	38.9	31.2
improved indigenous	11.00	1.20	10.00	6.00	4.82	39.6	24.1
crossbred	18.90	2.75	20.00	6.00	18.97	136.1	41.4
young stock { cross-bred	15.98	1.50	10.00	2.00	8.75	58.3	11.7
others	26.50	0.50	5.00	1.5	4.84	48.4	14.5
buffaloes							
males working and breeding	6.98	0.20	5.00	5.00	0.51	12.7	12.7
females milch and dry							
non-descript	12.99	0.50	5.00	5.00	2.37	23.7	23.7
improved	17.60	1.50	10.00	6.00	9.64	64.3	38.5
young stock	19.07	0.10	5.00	2.00	0.70	34.8	13.9
total for bovines					58.82	590.1	358.4
improved poultry	372.0 ⁴	..	..	..	8.06 ³	1.6 ³	..
improved sheep	60.00	0.30	..	0.4	6.57	..	8.8
improved goats	40.0	0.30	..	0.4	4.38	..	5.8
improved pigs	8.5	1.50 ²	1.00	..	4.65	3.1	..
horses & ponies	0.8	0.50	..	..	0.15	..	..
camels	1.0	0.50	..	..	0.18	..	..
					82.81	594.8	373.0

* Requirements for 'Others' cattle and buffaloes have not been given.

1 For some categories these are requirements in addition to grazing.

2 Assuming that about 80 per cent of the stock will be slaughtered at a marketable weight of 70 kg at 6 months of age.

3 Based on estimates in Chapter 31 on Poultry.

4 Provision for the improved poultry birds has been made.

TABLE 34.2

Estimated Requirement of Coarse Foodgrains for Livestock Feed in 1973 and 2000 AD

	1973			2000 AD		
	Pro- jected popu- lation (mil- lion)	Requirements (million tonnes)		Pro- jected popu- lation (mil- lion)	Requirements (million tonnes)	
		Con- cen- trate mix- ture	Coarse cereal grains		Con- cen- trate mix- ture	Coarse cereal grains
cattle & buffaloes	236.84	17.12	4.30	223.41	58.82	14.71
improved poultry	36.00	1.26	0.63	137.0*	8.06*	4.03
improved sheep	0.40	0.30	0.08	60.00	6.57	1.64
improved goats	0.68	0.45	0.11	40.00	4.38	1.10
improved pigs	0.32	0.22	0.11	8.50	4.65	2.33
horses and ponies	0.96	0.97	0.24	0.80	0.15	0.04
camels				1.00	0.18	0.05
total		20.32	5.47		82.81	23.90

* Details of working balanced ration for poultry have been given in Chapter 31 on Poultry.

3 AVAILABILITY OF FEEDS

34.3.1 Several attempts have been made to estimate the quantity of feeds that are available in India for consumption by animals. The most significant of these have been referred to here.^{1, 2, 3, 4} Most of these estimates were indirect in nature having been based on areas under fodder crops, forests, food crop yields per unit of area and on the estimated production of residues and byproducts available from food and cash crops. In one study estimates of overall feed consumption by cattle and buffaloes have been attempted based on the results of sample survey conducted by the Institute of Agricultural Research Statistics (IARS). In the following paragraphs, data obtained so far

1 Whyte, R.O., and Mathur, M.L. 1968. The Planning of Milk Production in India, p. 44, Orient Longman, Calcutta.

2 Human Nutrition vis-a-vis Animal Nutrition in India, 1954, pp. 13-14, Indian Council of Agricultural Research, New Delhi.

3 Report of the Committee on Livestock Feeds & Fodder, 1965, Central Council of Gosamvardhana, New Delhi.

4 Amble, V.N., Murty, V.V.R., Sathe, K.V., and Goel, B.B.P.S. 1965. Milk production of bovines in India and their feed availability, Indian Journal of Veterinary Science and Animal Husbandry, 35 : 221-33.

regarding the availability of various categories of feeds are briefly summarised :

Fodders (Dry)

34.3.2 *Kadbi* and other residues : These feeding stuffs are of comparatively poor nutritional quality but will perforce continue to form, for a long time to come, the major source of the roughages for Indian livestock. The quantity of feeds available from this source has been calculated by multiplying the yield of foodgrains with the ratio of straw to grain for the different crops. The estimates for availability of straws and *kadbi* in India are 174 million tons (Burns, 1944)¹ and 130 million tonnes (Central Council of Gosamvardhana, 1961)². Using similar methods, the Committee on Livestock Feeds & Fodders estimated the quantity of straws and *kadbi* in 1973 at 207 million tonnes³. Amble and co-workers⁴ on the basis of sample survey of feed actually consumed in certain selected localities estimated that 309 million tonnes of dry fodder were being consumed yearly by cattle and buffaloes only. These estimates are in excess of all the indirect calculations. It is probable that the studies made by the IARS included under dry fodder other feeding stuffs like hay, stalks from pulse crops and dried tree leaves. Therefore, the estimates of availability of straws made by the Ministry of Agriculture and Irrigation may be accepted. However, there is an urgent need for development of repeatable methods of realistic estimation.

34.3.3 Table 34.3 gives the amount of dry fodder which is estimated to be available in 2000 AD from the grain and oilseed crops.

TABLE 34.3

Availability of Dry Fodder in 2000 AD Resulting from Grain and Oilseed Crops
(million tonnes)

Crop	Production	Quantity of dry fodder
paddy	120	144.0
wheat	50	60.0
coarse cereals	65	128.0
pulses	35	18.0
groundnuts	13.5	6.8
		356.8

¹ Burns, W. 1944. Technological Possibilities of Agricultural Development in India. Quoted by Ramaswamy Nayudu in the Proceedings of Crops and Soil Wing Meeting 1945 of the Indian Council of Agricultural Research 1950. Manager of Publications, New Delhi.

² Report of the Committee on Livestock Feeds & Fodders, 1961, Central Council of Gosamvardhana, New Delhi.

³ Report of the Committee on Livestock Feeds & Fodder, 1974. Ministry of Agriculture and Irrigation, New Delhi.

⁴ Amble, V.N., Murty, V.V.R., Sathe, K.V., and Goel, B.B.P.S. 1965. Milk production of bovines in India and their feed availability. Indian Journal of Veterinary Science and Animal Husbandry. 35 : 221.

34.3.4 From table 34.3 it is seen that a total of 356.8 million tonnes of straws and stovers will be available from grain and oilseeds crops. Most of these materials will be used for feeding livestock as supplement. Straws and stovers are generally of low nutritive value and will not be adequate for the feeding of high producing livestock or their young ones during their periods of growth.

34.3.5 Cultivated green fodder : No accurate estimates are available of the amount of green forages cultivated annually. Previous estimates were made on *ad hoc* basis. The joint ICMR and ICAR Committee¹ indicated a supply of 111 million tonnes in 1954 for all livestock. The Central Council of Gosamvardhana estimated the availability of cultivated fodder at 132 million tonnes in 1961². Whyte and Mathur³ gave in 1965 an estimate of 142 million tonnes of green fodder availability for all bovines and changed it to 307 million tonnes in 1968⁴ based on IARS sample surveys.

34.3.6 According to available information⁵ the area under fodder crops in 1970-71 was 6.18 million hectares. Out of this 1.02 million hectares was irrigated and cropped twice. No record is available of the types of fodder species grown. In the absence of data on acreage under different crops it is difficult to get any realistic idea about the total yield of fodder as well as of the nutrients provided to the livestock from cultivated fodders. As cultivated fodder crops are of great importance in livestock feeding, we recommend that arrangements should be made to collect data on area and yield under different fodder crops regularly along with those for other crops.

34.3.7 For want of any survey data the Livestock Feeds and Fodder Committee⁵ of the Ministry of Agriculture and Irrigation estimated an average fodder yield of 50 tonnes per hectare of irrigated land and 25 tonnes per hectare for unirrigated area under cultivated fodders. The total production of green cultivated fodder was estimated to be 214 million tonnes in 1973. In 2000 AD the land under fodder is estimated to be 16.50 million hectares including 6.5 million hectares of irrigated land. On the above basis the availability of cultivated fodder is estimated to be 575.0 million tonnes on green basis.

34.3.8 Grazing : In addition to straws, *kadbi* and cultivated green fodder, grass from forest lands, community pastures and other monsoon grasses which grow on uncultivated land, roadsides, canal banks,

1 Human Nutrition vis-a-vis Animal Nutrition in India, 1954, p. 23, Indian Council of Agricultural Research, New Delhi.

2 Report of the Committee on Livestock Feeds & Fodder, 1965. Central Council of Gosamvardhana, New Delhi.

3 Whyte, R.O. and Mathur, M. L., 1965. The concentrate feed situation for poultry and dairy industries in India, Indian Farming, 17 : 323-33.

4 Whyte, R.O. and Mathur, M.L., 1968. The Planning of Milk Production in India. p.8, Orient Longman, Calcutta.

5 Report of the Committee on Livestock Feeds & Fodder, 1974. Ministry of Agriculture and Irrigation, New Delhi.

bunds etc. contribute substantially to livestock feed resources. Sometimes these grasses are harvested and fed directly or after storage to livestock but mostly they are grazed. The quantity of grass thus consumed by grazing or harvested and then fed to livestock is difficult to estimate as the growth of grass and its accessibility for grazing/harvesting vary from place to place and from season to season. Some *ad hoc* estimates have placed the quantity of fodder available from this source to be (a) 525 million tons¹ and (b) 288 million tonnes². The Report³ of Livestock Feeds and Fodder Committee of the Ministry of Agriculture and Irrigation gave a figure of only 13 million tonnes based on the yield of 1 tonne per hectare from 13 million hectares in grassland not classified under forest. This excludes forest grazing. In the Report of the Central Council of Gosamvardhana also the figure of 288 million tonnes did not include any grazing in forest areas.

34.3.9 For another alternative method of estimation of the fodder obtained from monsoon grasses we have assumed that all indigenous cattle and buffaloes excluding milk and draught animals obtain their full requirements for three monsoon months and half their requirements for the next three postmonsoon months from this source. We have further assumed that on the basis of 200 kg as the average body weight per bovine, dry matter requirement of 4 kg per head per day and 25 per cent dry matter in grass, an average bovine will consume 16 kg of grass per day or 2.16 tonnes of grass per season. On this basis the total availability of monsoon grasses for 200 million bovines not used for work or milk comes to 430 million tonnes (1972). These estimates do not include grazing in winter monsoon or by livestock other than cattle and buffaloes. The wide discrepancy in the various estimates highlights the difficulty in coming to any valid conclusion regarding the exact quantities of extra forages/grasses that become available to livestock through grazing.

34.3.10 Tree leaves : Tree leaves constitute a useful source of fodder, particularly during scarcity period. Goats and camels derive their major portion of sustenance from tree leaves, which are either browsed by them or hand fed from lopped branches. As this is done by small individual stock owners, availability of nutrients from tree leaves, thus consumed by livestock cannot be easily determined.

34.3.11 Concentrates of plant origin : This category of feed consists of oilcakes, brans, coarse grains, cottonseed etc. Unlike the

1 Human Nutrition vis-a-vis Animal Nutrition in India 1954. p. 23, Indian Council of Agricultural Research, New Delhi.

2 Report of the Committee on Livestock Feeds & Fodders. 1965. Central Council of Gosamvardhana, New Delhi.

3 Report of the Committee on Livestock Feeds & Fodders. 1974. Ministry of Agriculture and Irrigation, New Delhi.

feedstuffs mentioned in previous paragraphs, the production figure of concentrate feeds of vegetable origin is more or less accurately known. What is, however, not clearly established is how much of the amounts produced are actually available for stock feeding purposes. The most recent calculations as reported by the Committee on Livestock Feeds and Fodder of the Ministry of Agriculture and Irrigation (1974) are shown in Table 34.4.

TABLE 34.4

Estimated¹ Availability of Different Feeds Based on Total Production of Foodgrains and Oilseeds 1971-72

(million tonnes)

Sl. No.	Item	1971-72		Remarks
		Total production	Available for feed	
1.	coarse grains	24.494	0.490	Based on 2 per cent availability.
2.	edible oilcakes	3.419	2.769	This availability depends upon the
3.	cottonseed	1.980	1.785	export policy of
4.	rice and wheat bran	4.852	4.678	the Government of
5.	pulses byproducts	11.093	1.331	India which changes
	total		11.053	from time to time.

¹ Report of the Committee on Livestock Feeds and Fodders 1974. Ministry of Agriculture and Irrigation, New Delhi.

It will be seen from the above table that certain assumptions have been made regarding the availability for livestock feeding of coarse grains and certain byproducts out of the estimated total production for livestock feeding. The figure of about 11 million tonnes availability is much lower than the estimated 17.4 million tonnes¹ of concentrates being consumed at present by bovines in India. This is rather difficult to understand and again shows the difficulty in making realistic assumptions and estimates for India as a whole or for individual States or for milksheds, intensive livestock development blocks etc. and highlights the need for standardization of methodology for such estimates. We recommend that a standard method for the estimation of availability and requirements of feeds should be developed by the IARS.

34.3.12 In 2000 AD it is estimated that 25 million tonnes of

¹ Amble, V. N. Murty, V.V.R., Sathe, K. V., and Goel, B. B. P. S. 1965, Milk Production of bovines in India and their feed availability. *Indian Journal Vet. Science and Animal Husbandry* 35 : 221-33.

coarse cereal grains will be available for feeding livestock. This amount will include maize, barley, oats and other small millets. In addition, 5.67 million tonnes of bran from rice and wheat and 4.38 million tonnes of chunies from pulses are estimated to be available in 2000 AD for livestock feeding. The total production of edible oilcakes for livestock in 2000 AD is estimated to be 42 million tonnes, all of which will be suitable and available for feeding livestock. The availability of concentrates from plant origin in 2000 AD is given in Table 34.5.

TABLE 34.5

Availability of Concentrate Feeds of Plant Origin in 2000 AD for Feeding Livestock

coarse cereal grains	25.00	million	tonnes
brans from wheat and rice	5.67	"	"
chunis from pulses	4.38	"	"
oilcakes	42.00	"	"
total	77.05	"	"

Concentrates of Animal and Marine Origin

34.3.13 Meatmeal, meat scraps, bonemeal etc.: The annual production of discarded meat, i.e., meat condemned for human consumption and meat adhering to bones is estimated to be of the order of 23,000 tonnes. Further, the annual output of the offals from slaughtered animals is estimated to be 50,000 tonnes. These offals after being steam-treated can be profitably utilised for animal feeding. In addition to the animals slaughtered in organised slaughter houses, about 22.8 million carcasses of fallen animals per year can be processed to yield meatmeal. Assuming that even 50 per cent of such carcasses can be processed, nearly 2 million tonnes of meatmeal can be made available for stock feeding. In spite of this enormous potential valuable poultry and pig feed from slaughtered and fallen animals, very little of discarded meat or meat products are actually processed and made available for livestock consumption. Instead practically the whole amount of such valuable feeds are now wasted.

34.3.14 Bloodmeal : On a rough estimate nearly 150 thousand tonnes of blood can be obtained from slaughtered animals. Some 36 per cent of this amount is utilised for pharmaceutical and other purposes, while the rest is wasted. Very little or none is yet used for stock feeding.

34.3.15 Fishmeal : India's production of fishmeal is estimated to

be about 20,000 tonnes per annum. Major portion of this is used as manure and about 4,000 tonnes are used annually for incorporation into compounded feeds for poultry.

34.3.16 Molasses : Molasses is an important item in livestock feeding and can be one of the cheapest sources of energy. Addition of molasses also helps to improve the quality and palatability of dry feeds. Production of molasses in the year 1972-73 was of the order of 1.5 million tonnes. Major part of this is being utilised by the alcohol industry and only a small quantity is available for livestock feeding. The exact amount thus utilised for the latter purpose is not known. However, from the output of compounded feed mixtures for livestock, it is estimated that about 28,000 tonnes are used for compounded feeds. Assuming another 10 per cent being used by private owners, the total quantity of molasses thus available for livestock feeding will be about 30,000 tonnes.

34.3.17 The estimated availability of only some concentrates of plant origin could be quantified and has been shown in Table 34.5. The availability of many concentrate feeds of plant and animal origin cannot be realistically estimated. These include sources of feed which may be of considerable importance such as sal seed and other cakes from minor oilseeds, bloodmeal, meatmeal, fishmeal and silkworm pupae, byproducts of agro-industries like sugar, distillery, starch, soyabean etc. In addition the contribution of the use of nonprotein, nitrogen, synthetic amino acids etc. has not been quantified. These products and byproducts are likely to be substantial in quantity and will be of great importance in providing a balanced diet to productive livestock and their followers.

4 REQUIREMENTS VIS-A-VIS AVAILABILITY OF LIVESTOCK FEEDS

34.4.1 In Section 2, the requirements of different feeding stuffs for providing suitable rations for all categories of animals have been outlined. These figures are compared with the amounts available in Tables 34.6 and 34.7.

34.4.2 It will be seen from the Table 34.6 that the availability of all categories of feeds falls far short of estimated requirements in 1973. A part of the shortage is made good through grazing, but even then the deficit is quite large. Four hundred and thirty million tonnes of green grass grazed (vide paragraph 34.3.9) will only be equivalent to about 100 million tonnes of dry fodder. In fact, Livestock

Feeds and Fodder Committee¹ postulated that in 1978-79, due to increase in number of improved animals, the requirements will be 25.445, 353.0 and 388.07 million tonnes for concentrates, dry fodder and cultivated fodders respectively. The availabilities are estimated to be 16.464, 300.54 and 261.00 million tonnes respectively. Though the position regarding the availability of dry fodder will not be very bad, the gap between the availability and requirements of concentrates and green fodder will be colossal. Such a situation is bound to aggravate difficulties in the feeding of particularly the better class of livestock who will fail to portray their full genetic potentiality for high production. It is, therefore, essential to find ways and means to bridge the widening gap between requirement and availability of feeding stuffs. This subject has been dealt with in greater detail in this section and in Sections 5 and 6.

TABLE 34.6

Requirements and Availability of Different Feeds in 1973¹

(million tonnes)			
Type of Feed	Requirements	Available	Remarks
concentrates	19.565	11.053	
dry fodder	347.410	207.000(a)	(a) excluding hay or other dry fodder.
		309.000(b)	(b) the Committee probably took into account hay and dry fodder consumed.
green fodder	343.57	214.5	

34.4.3 The requirements and availability of livestock feeds in 2000 AD are estimated as given in Table 34.7.

TABLE 34.7

Estimated Requirements of Feeds vis-a-vis Availability in 2000 AD

(million tonnes)			
	Requirement	Availability	Excess or deficit
concentrates of plant origin	82.8	77.05	(—)5.75
green fodder	594.8	575.0	(—)19.8
dry fodder	373.0	356.8	(—)16.2

¹ Report of the Committee on Livestock Feeds and Fodder, 1974. Ministry of Agriculture and Irrigation, New Delhi.

The above estimates do not include many sources of animal feeds the availability of which cannot be quantified at this stage. These include amongst concentrate feeds like fishmeal, meatmeal and bloodmeal; byproducts of the tapioca, brewery, sugar, starch and pharmaceutical industries and other byproducts from sal seeds, fruits etc. Availability of materials of comparatively high bulk and low nutritive value such as sugarcane tops, proteins from petro-chemicals and algae is also not included. It is expected that with the addition of the above sources of livestock feeds the deficit now shown in Table 34.7 may be made good and it will be possible by 2000 AD to ensure the feeding of all productive livestock on balanced diets during their periods of growth, production and reproduction.

34.4.4 It has been shown above that the gap between the requirement and availability of livestock feeds is very wide at present though by 2000 AD the projections indicate that it will be possible to feed livestock on balanced rations. During the intervening years, if increase in the production of milk, meat, eggs and wool for the growing human population is to be achieved, every effort must be made to narrow down this gap. It can be attained by (a) reducing feed requirements and (b) by increasing feed supply.

Reducing the Feed Requirements

34.4.5 To reduce feed requirements without decreasing production, several steps can be taken. One of the effective steps would be to progressively eliminate the unproductive stock. The methods by which this can be achieved have been discussed in Chapter 28 on Cattle and Buffaloes. Considerable economy of feeds can be effected without detriment to crop production if two or more farmers can be induced to share a pair of bullocks for cultivation of their lands instead of each farmer owning a pair. As most of the landholdings are small, such an arrangement should not hamper agricultural operations. Considering the difficult feed situation and the necessity of conservation of feed for getting the maximum output, attention should primarily be devoted to the feeding of balanced ration to the adult stock or superior exotic, crossbred and indigenous breeds and their followers. The low producing uneconomic stock and the unproductive animals can be sustained, till they are culled and eliminated, on whatever feeds may be available after taking adequate care of the superior economically productive stock. In a study carried out at the Indian Veterinary Research Institute (IVRI), it was observed that in some areas milk animals, particularly in cities, and work animals during periods of heavy demand are being overfed. Avoidance of such incorrect

feeding would also add to the saving of feeds. Popularisation of feeding livestock with balanced feed mixtures will reduce wastage and ensure economy. Economy in feed can also be achieved by reducing the unproductive periods of the life of cattle, viz., the age till attainment of maturity and calving intervals, as this would shorten the dry periods of the animals. Much wastage in feed is caused by the parasitic load carried by the animals. Reduction and elimination of worm burden is an effective way of feed conservation, particularly in tropical and subtropical regions where parasitism is a serious disease problem. Concerted action on all these items is necessary to ensure optimum results.

34.4.6 To attain the objective of reducing demand for livestock feeds, planned economic pressure and educative propaganda will be the main instruments. For each village or contiguous group of villages, particularly for areas where intensive livestock production programmes are being taken up, such as Intensive Cattle Development Projects (ICDP) the subject should be studied in depth. The study should cover evaluation of total feed resources, potentiality for increasing feed supply, number and kind of animals that can and should be kept efficiently on the available feed resources etc. Action programmes should then be drawn up with the object of decreasing demands on animal feeds in a phased manner.

5 WAYS AND MEANS TO INCREASE AVAILABILITY OF FODDERS

34.5.1 Increasing feed availability: The steps that can be taken for increasing the feed supply must be considered for feeds under the two major heads, fodders and concentrates as discussed below :

Fodders

34.5.2 Grazing : Grazing has been dealt with in Chapter 41 on Forest Policy, Chapter 42 on Production and Social Forestry and Chapter 25 on Fodder Crops. In addition, the subject has been dealt with in our Interim Reports on Social Forestry and Desert Development. Livestock in India obtain a considerable amount of their nutritional requirements by grazing. It was estimated¹ that 90 per cent of the country's cattle population subsists on grass in grazing areas in and

¹ Mehta, T.R. 1974. Advances in plant science relevant to meeting the food and feed needs of the nation. Paper presented at the National Symposium on Agricultural Research and Development since Independence. Indian Council of Agricultural Research, New Delhi.

outside the forests. In this type of feeding all species and classes of animals are involved. The lands involved include fallow lands, river banks, road sides, uncultivable waste and forests. It is estimated that 14.8 million hectares of land is under grass lands and 66.00 million hectares under forest some of which is used for grazing and/or cutting of grass. The availability of such uncontrolled grazing has had a deleterious effect on the development of livestock as the livestock owner has felt satisfied with the limited output for little or no input on his part. Overgrazing or trampling by animals causes depletion of pasture grasses, soil erosion and eventual degeneration of forest area. The cost of such grazing to the community is thus enormous, but to the owner, the animals are profitable. Motivation for improvement of pastures and animals has, therefore, been lacking. The possibility of restricted grazing and/or of levying progressively heavier charges for grazing should be considered as a means for the elimination of uneconomic cattle and other livestock and improvement of pasture yields through systematic grazing and scientific management.

34.5.3 For increasing productivity of grass from unowned land no heavy investment in capital or even labour can be made. Any discussion of management for improvement of yield of this land is often considered to be of an academic interest only. However, in selected areas considerable gains can be made by limiting grazing, adopting rotational grazing, periodic burning of vegetable cover and other such easy but not-too-expensive practices. Furthermore, if all unoccupied land is planted with trees and bushes or seeded with self-regenerating grasses and legumes it will provide soil cover and check soil erosion. Fallow lands can be similarly sown with quick growing plants to prevent soil erosion and weeds. Pastures that are owned by individuals or jointly by the community can be and should be improved through systematic management and by introduction of nutritious grasses and legumes with the application of fertilizers as recommended in our Interim Reports on Social Forestry and Desert Development. In areas where intensive livestock production programmes are taken up, a study should be made of the natural grasses, their cycle of growth, productivity and nutrient yields. The potential for improvement should be evaluated by a team of experts including specialists in grassland management, livestock development and agricultural economics and action programmes drawn up for improving grass and fodder yields. By taking these steps, it has been estimated by the Livestock Feed and Fodder Committee (1974) of the Ministry of Agriculture and Irrigation, that the total availability of green fodder through grazing can be raised by 20 per cent by the end of the Fifth Five Year Plan.

34.5.4 Pastures and grazing areas in forests near habitation and

roads are overgrazed and those away are undergrazed. Efforts should be made to rejuvenate and maintain productivity of overgrazed pastures and to increase the utilization of grass from the areas at present under-utilised because of inaccessibility. This can be done economically by several methods : (a) by cutting and storing grasses as hay in fodder banks; (b) by establishing young stock and dry cattle camps; and (c) by setting up gosadans near these places. In each case cost-benefit ratio will have to be worked out. Railway concession on transport of animals to such sources of grass and for movement of grass stores after baling at rail heads near inaccessible grasslands may encourage taking up the above steps, and is strongly recommended.

34.5.5 With regard to the forest grazing, we would like to reiterate the following recommendation made in Chapter 41 on Forest Policy (paragraph 41.5.22) :

“...grazing in forest areas should be strictly controlled and regulated so that it does not interfere with the productive and protective functions of the forests....A grazing fee should be charged, but it should not be so small as to encourage the owners of non-essential livestock to bring their animals for grazing in the forest areas. The resources of the forest areas should be utilised only for feeding of the essential livestock.... it is desirable that wherever grasses can be grown in forest lands without detriment to the tree growth, and where an effective demand for grasses exists, such lands should be utilised for grazing and for provision of hay for feeding livestock outside the forests. Grazing by goats in forest lands should not be allowed.... Sheep grazing may be allowed only in specially earmarked grasslands in the forest areas, under strict rotational control.”

Trees and Shrubs as Source of Fodder

34.5.6 Leaves of trees and shrubs are important source of fodder for livestock even in normal times and more so during periods of scarcity. Camels and goats in particular obtain a major portion of their nutrient requirements from leaves of trees and shrubs such as *jharberi* or *pala* (*Ziziphus numularia*), *khejri* (*Prosopis cineraria*) *vilayati babul* (*P. juliflora*), *babul* (*Acacia nilotica*), *sissoo* (*Dalbergia sissoo*), the figs (*Ficus sp.*), *kanthal* (*Artocarpus integrifolia*) etc. In hill areas trees are regularly lopped for feeding sheep, goats and even other farm animals. During periods of scarcity, tree leaves are greatly sought after as a source of fodder. In addition to forest trees there are large number of trees in cultivated lands, habitations, waste

lands, road sides etc. These resources are of considerable potential value as livestock feed and can be greatly developed by increasing the number of such trees and managing them for optimum yield.

34.5.7 We recommend that for each district or intensive livestock development block a list of existing fodder bearing trees, shrubs and bushes should be prepared. A study should be made of their modes of reproduction and growth and steps should be taken to increase their number and yield by protection and better management, and propagating them particularly on wastelands not suitable for grasses, on usar lands and on waterlogged areas. Every State Government should establish fodder nurseries to supply seeds and seedlings of grasses and fodder trees.

34.5.8 There is also need for a detailed study of all wastelands for identifying areas that have a potential for the development of fodder trees and grass resources, so that plans can be drawn up under the social forestry programmes for development of these areas. In soil erosion control measures, due consideration should be given to the possibility of planting fodder trees to enhance livestock feed resources of the area. For the proper planning of programmes, judicious conservation and utilisation of fodder trees, grasslands and hay, and for reviewing the working under these programmes from time to time, there should be a coordinating body in the State headquarters consisting of the heads of departments of forest, sheep development, animal husbandry, dairy development and agriculture. Formation of a similar inter-departmental coordinating committee at the district level would be necessary.

34.5.9 Fodder from cultivated lands : Cultivated lands provide three types of fodder : (a) cultivated fodder; (b) fodder as a by-product, straw, *kadbi* etc.; and (c) weeds from fields growing food-grains and other cash crops. All these sources contribute greatly to the total feed resources.

34.5.10 Cultivated fodders occupy only 6.91 million hectares, i.e. less than 5 per cent of the area under cultivation in the country. A large proportion of this land lies in Punjab, Haryana and Gujarat where livestock of comparatively high productivity are found. In other States the proportion of cultivated land used for fodder is very low. Low acreage under fodder is due to greater demand for and higher profits from food and fibre crops. If productivity per capita of livestock and the price of livestock products in relation to the cost of production of the animal feeds can be raised, the economics of producing fodder in competition with grain and other cash crops will improve and a greater proportion of land will be used for cultivated fodder. Steps that can be taken to increase fodder yield have

been dealt with in Chapter 25 on Fodder Crops.

34.5.11 Studies have shown that it is more economical to raise the high producing animals on green fodders than on straws and concentrates. Therefore, high yielding fodders and legumes and cultivation practices for obtaining optimum yields of nutrients from them should be evolved so that in land used for fodder, higher economic returns in comparison with other crops can be obtained. This is possible through the sale of fodder to other animal owners, landless labourers and marginal farmers etc. or by sale of livestock or livestock products. Research on this subject underway at Indian Grassland and Fodder Research Institute (IGFRI), Jhansi and under a coordinated programme of the ICAR at several other stations should be intensified.

34.5.12 It is a well known fact that the stage of harvesting the fodder crop plays a vital part in obtaining the maximum palatability and digestible nutrients. The optimum stage at which such fodders should be harvested has generally been established in studies at IVRI, IGFRI, CAZRI and NDRI. The information collected so far should be popularised so that maximum quantity of nutrients per hectare of land is obtained. Further research on these lines in different agroclimatic zones is also necessary so that the maximum benefit from the cultivated forages may be obtained throughout the country.

34.5.13 In areas where intensive livestock production is taken up, cultivation of fodder may be encouraged by educative propaganda, advice, supply of seed material and fertilizers. In these areas cultivated fodders will be of prime importance as it will be impossible to meet the nutritional demands of improved types of livestock without cultivated fodders.

34.5.14 Fodder as byproduct from grain farming : After harvesting grain or fibre, the remaining parts of the plants are collected and used, if edible, as fodder. Almost all the fodder so harvested at present is used as feed for livestock.

34.5.15 Weeds as cattle feed : The usual practice of the large farmers is to supplement their own labour with hired labour for weeding and thinning and to permit labourers to take all or a portion of the weeds as a part of remuneration. Weeds in many areas, particularly where grazing lands are not available and for animals owned by landless labourers and marginal farmers, are an important source of nutrition generally for the productive animals. Increase in mechanical and chemical weeding will reduce availability of livestock nutrients from this source. However, as high yielding crops will require and justify better care and will also increase the benefits of more intensive weeding, the net result is likely to be greater availability of

livestock nutrients from weeding. No quantitative estimates are possible at this stage of the net availability of weeds for feed.

34.5.16 Cropping Programme : The feeding of green fodder to the animals all the year round is important to supply essential nutrients economically. A large number of cropping programmes have been developed by the research institutes for maximising fodder production. Some of these programmes provide fodder as a part of mixed farming while others are designed to provide green fodder all the year round. These programmes which include fodder production as a part of production of other cash, food and fibre crops seem to be more acceptable to the average farmer. The cropping programmes which provide for all the year round fodder production are more satisfying to the farmer who has taken to intensive milk production and/or to sale of fodder to urban, suburban areas or to small farmers.

34.5.17 The measure of efficiency of various fodder crops is generally the gross yield in tonnes per hectare. This is particularly the case where sale of fodder is the aim and the purchaser is not quality conscious. However, it can be very misleading. The yield of nutrients in terms of digestible crude protein (DCP) and total digestible nutrients (TDN) per hectare should be the real measure for selection of the most suitable time for harvesting for any fodder in any agro-climatic condition. For this purpose the most economical cultivation practices and the optimum stage when the fodder is to be harvested must be determined for each crop.

34.5.18 Future work should also be directed towards studies on new crops, crop combinations and cultural practices to maximise the yield of livestock feed nutrients per unit of input in land, capital and labour. Extension effort should be directed towards making the results of these studies known and accepted by the animal owners, fodder producers and farmers.

34.5.19 Post harvest technology : During the monsoon the supply of grasses is usually much more than the demand for immediate consumption by livestock. This surplus grass can be stored as hay or silage. Near forests and hills where such storage operations can be taken up on commercial scale, it will be advantageous to set up hay baling and storing facilities for subsequent transportation to places of demand. As recommended earlier (paragraph 34.5.4), concessions should be allowed by the Railways for transportation of hay from railheads to areas of intensive livestock production. Concessions should not be allowed for transport of hay to urban areas in general and particularly to cities like Bombay, Calcutta, Delhi and Madras. This may ultimately discourage maintenance of livestock for milk in urban areas.

Silage

34.5.20 Silage making unfortunately has not become very popular in the country except on a few Government farms in spite of efforts made in this direction sporadically. The process offers considerable potentialities for adoption on a community basis where large cooperatives of milk producers or processors of other livestock products are organised. The possibility of harvesting grasses on community basis, ensiling these and later sharing the silage by the community should be encouraged by cooperative unions. Massive efforts in educative propaganda are needed for making the use of silage popular in this country as this will save a lot of wastage of valuable green feeds. The extension workers in the field of fodder production and crop husbandry should give this high priority. In limited areas where surplus grasses are available and conditions for hay or silage making are not favourable, it may be economically feasible to set up plants for artificial drying of monsoon grasses. This holds good particularly for hilly or high rainfall areas. The Indian Grassland and Fodder Research Institute and agricultural universities should conduct feasibility studies to find out the economic viability of such enterprises.

34.5.21 Considerable loss occurring in the feeding of fodders can be avoided by adopting proper methods of preparation and use of fodder. Stalks of *chari* and maize should be chaffed to proper size depending on the species of animal to be fed. Feeding value of poor hays, straws and fodders can be greatly increased by supplementing them with legume fodders, or by treatment with alkali or by addition of molasses and urea.

34.5.22 The first essential for each area where intensive livestock production project is to be taken up is to conduct a survey of feeding practices and draw up a programme for minimising wastage, utilising nutritive fodders and to enhance feed value of coarse roughages in order to increase feed resources. For this purpose, an Animal Nutrition Officer should be provided for each major livestock development project and should be provided with all necessary facilities like staff, transport, laboratory etc.

6 WAYS AND MEANS TO IMPROVE AVAILABILITY OF CONCENTRATE FEED

34.6.1 The feeding of concentrates has not been given its rightful place in the traditional system of livestock husbandry in the country.

Animals generally subsist and produce on agricultural byproducts and casual grazing. The input of concentrates is estimated¹ around 1 per cent of the total material cost for the feeding of cattle. However, changing agricultural economy which involves more and more of commercial farming will need better types of animals with higher yields. For feeding these high yielders, concentrates must play a very important role. Though the digestive systems of cattle, buffaloes, equines, sheep, goats and other domestic animals is adapted to the utilization of coarse fodders, yet for high yielding animals or when sufficient green fodder of suitable quality is not available, concentrate feeding is essential. The least cost system of feeding ruminants under commercial conditions is to feed principally home grown nutritive fodders. Experiments at the IVRI and the National Dairy Research Institute (NDRI) have shown that good quality forages can support up to 8 kg milk production in cattle and buffaloes. For higher production, concentrate supplementation is essential, because the animals cannot obtain adequate nutrients through fodders for meeting the high requirements of growth and production.

34.6.2 In Section 3, we have stressed that the difference between the availability and requirement of concentrate feeds for supplying balanced rations to all categories of livestock in 1973 was roughly 8.5 million tonnes. In the following paragraphs, ways and means have been suggested how this gap can be bridged.

34.6.3 A variety of feeding stuffs contribute to the concentrates in rations for livestock. For convenience these may be considered in four groups: (a) foodgrains and foodgrain byproducts including pulse byproducts; (b) oilseeds and oilcakes; (c) fisheries and slaughter house byproducts; and (d) nonconventional feeds and feed additives.

34.6.4 Foodgrains as livestock feed: Cereal grains and their byproducts constitute an important part of the concentrate feed, primarily for fast growing and commercially productive animals. These are palatable and high in starch and total digestible nutrients. They are low or relatively low in fibre and protein content. The quality of the protein is also not very high and in the case of nonruminants, a supplement of animal protein or other lysine and methionine rich protein is advantageous.

34.6.5 It was estimated² by CCG that for balanced feeding of the then (1956) livestock population, 7 million tonnes of maize and 7 million tonnes of barley were required against which the quantities available for feeding livestock were negligible. Estimates³ for 1972-73

1 Alagh, Yoginder K. 1974. *Dualism and dairy development in India*. Note presented to the International Dairy Federation Annual Session, New Delhi.

2 Report of the Committee on Livestock Feeds and Fodders. 1965. Central Council of Gosamvardhana, New Delhi.

3 Report of the Committee on Livestock Feeds and Fodders. 1974. p. 9-10. Ministry of Agriculture and Irrigation, New Delhi.

show that on the basis of 2 per cent availability, 0.490 million tonnes of coarse grains were available for feed. In 1978-79 the availability will be 0.680 million tonnes. This will be still far short of the requirements for the productive livestock in the country. It is estimated that by 2000 AD 25.03 million tonnes of coarse grains will be available for use as livestock feed. There is a possibility of further increasing the yield of coarse grains if cultivation of high yielding coarse grains suitable for livestock feeding is taken up on a large scale.

34.6.6 The finer foodgrains, such as rice and wheat are not generally used for feeding livestock except broken, damaged and spoiled grains which are sometimes available in small quantities and are still usable for feeding livestock. The quantities available or likely to be available cannot be estimated with any degree of accuracy but are of insignificant magnitude. In the disposal of such grains from the public distribution system, the organised livestock feed industry should be given preference to ensure that grains unfit for human use are used for livestock only. The nontoxicity of the material for the animals should be ascertained beforehand.

34.6.7 We recommend that while selecting varieties of foodgrains for extensive cultivation, special varieties with high yield of total nutrients for livestock feeding should be given due importance. High yielding varieties like dent variety of maize, though not of high quality for human consumption, should be selected in preference to low yielding varieties suitable for human use particularly in areas where the coarse grains are used for livestock feeding. Use of maize for poultry feed has been dealt with in greater detail in Chapter 31 on Poultry. We further recommend that research and extension on high yielding coarse foodgrains should be intensified.

34.6.8 Cereal byproducts: Cereal byproducts used for livestock feed include byproducts of the milling, bakery, starch, glucose, brewery and other industries based on foodgrains. The principal byproducts used in livestock feeding are the brans from rice, wheat and maize.

34.6.9 Estimates of quantities available from these sources for livestock feeding cannot be made realistically except for brans of which the availability was estimated at 3.2 million tonnes¹ in 1956 and 4.678² million tonnes in 1972-73. It is estimated that in 1978-79, 6.190 million² tonnes of rice and wheat bran will be available for livestock feeding. We have estimated in Chapter 11 on

1 *Animal Nutrition vis-a-vis Human Nutrition in India*. 1954. Indian Council of Agricultural Research, New Delhi.

2 Report of the Committee on Livestock Feeds and Fodders. 1974. Ministry of Agriculture and Irrigation, New Delhi.

Supply Possibilities that in 2000 AD the production of rice in terms of paddy and wheat will be 170.0 million tonnes. Bran constitutes about 10 per cent of the foodgrain and if about one-third of the total grain production passes through the milling industry, the estimated availability of brans for livestock feeding will be 5.67 million tonnes.

Screenings

34.6.10 The screenings generally contain small grains, weed seeds and dust. The last can be removed by suitable processing to make clean screenings available for livestock feeding. The composition of screenings varies from batch to batch depending on the type and proportion of various seeds contained therein. These can, therefore, not be used in balanced compounded livestock feeds without analysis of individual batches. Unwashed screenings are generally high in insoluble ash and their use should be avoided in livestock feed. They can, however, be fed to backyard poultry where the birds can pick up the foodgrains and leave back grit and other undesirable objects.

Wheat Bran

34.6.11 As a livestock feed, wheat bran is highly palatable and mildly laxative. It is richer in protein, fat and fibre than the whole wheat itself but lower in starch. It is rich in phosphorus but poor in calcium. Wheat bran is almost exclusively used for livestock feeding.

Rice Bran

34.6.12 Rice bran is fairly palatable when fresh but often turns rancid on storage because of high oil content. By heating and drying the keeping quality of rice bran can be improved. As rice bran contains considerable quantity of oil, it is used for extraction of the oil by solvent extraction process. The residual bran is equally suitable for livestock feed and has better keeping quality. The composition of rice bran depends on the amount of rice husk used in the milling process. Recently the equipment for processing paddy into rice has been improved with the result that the percentage of broken rice is reduced and rice yield is increased. This processing also decreases the percentage of fibre in the bran and improves the quality. We recommend that improved milling of rice should be popularised to make rice bran of suitable quality available for feeding animals.

Rice Polishings

34.6.13 Rice polishings have high protein and fat content but are low in ash and fibre. As such rice polishings are highly valuable food for poultry and pigs. However, due to the high fat content they are liable to deteriorate rapidly. Investigations should be taken up to preserve the quality of rice polishings on longer storage. Solvent extracted rice polishings have better keeping quality and can be used for livestock feeding. The extraction of rice polishings for recovery of oil should be encouraged.

Other Grain Byproducts

34.6.14 In addition to screenings and brans, other foodgrains byproducts are obtained in the preparation of starch and glucose from maize and tapioca and of beer from barley. Still other byproducts are produced, for instance, in baking and other food industries but they are insignificant in amounts and can be ignored. In the preparation of starch and glucose from maize, the byproducts are (a) the germs from which most of the oil is later extracted (b) the bran (c) the gluten and (d) the maize solubles. In the developed countries, all these four byproducts are generally sold after drying separately or together as maize gluten feed and contribute considerably to the total feed resources.

34.6.15 In the breweries, barley is used for production of beer and the main byproduct is the spent grain called the brewer's grain. In India, these and the starch/glucose byproducts referred to above are mostly sold in the wet form for use mostly as fodder in the neighbourhoods of the starch/glucose plants and breweries and are not processed for sale as concentrates for livestock feeds. Besides, another valuable byproduct, brewer's yeast which is rich in proteins and vitamins is being marketed by a few breweries only. However, this product forms a very small percentage of the total produce.

34.6.16 Proper processing of byproducts should be made a condition for the licensing of the foodgrains industries, so that byproducts are compulsorily processed and made available to the livestock industries for the purpose of feeding. We further recommend that the livestock feed industries should carry out feasibility studies to examine if they can themselves take over the byproducts in the raw form and utilise them economically in the compounded livestock feeds.

Oilseeds and Oilcakes

34.6.17 Oilseeds : Cottonseed is the only oilseed which is used as

such for livestock feed. It is mainly used in Maharashtra, Gujarat, Rajasthan, Haryana and Punjab for the feeding of buffaloes in milk and sometimes working animals. The feeding of oilseeds without removal of the oil is done in the belief that fat content of the milk is increased and that it leads to greater recovery of fat from milk by the indigenous method of churning. None of these beliefs have been experimentally confirmed. The oil contained in the oilseed is valuable for industrial purposes. If the energy lost in oil extraction is made good by feeding the cake along with cheaper sources of carbohydrate-rich supplements then the feeding of seed itself will be uneconomical. We, therefore, recommend that in areas where cottonseed is traditionally fed to livestock, concerted campaigns about the value of cottonseed cake and different substitutes to replace cottonseed as livestock feed should be launched by the compounded livestock feed industry, animal products industries and oil crushing industry in the public, private and cooperative sectors. They should provide these substitutes or balanced compounded feeds at reasonable prices and in adequate quantities. The agricultural universities and the Animal Husbandry Departments of the State should undertake educative propaganda for popularising feeding of cottonseed cake instead of cottonseed.

34.6.18 Oilcakes : Oilcakes constitute an important source of nutrients for livestock particularly the livestock used for commercial production and heavy drought. It was estimated¹ in 1954 that the availability of oilcakes was 2.3 million tonnes. In 1972-73, the estimated² availability of oilcakes for feed was 2.769 million tonnes and in 1978-79 the projected availability will be 5.1 million tonnes excluding 0.1 million tonnes for export and 0.041 million tonnes for other uses. We have estimated that 42 million tonnes of cakes and meals will be produced in the year 2000 AD.

34.6.19 Oilcakes are generally rich in proteins and are thus used as protein supplements particularly in the rations of livestock that require high quantities of protein such as growing animals, lactating animals, egg laying birds and animals in advanced stage of pregnancy. Oilcakes are also essential in the rations which are otherwise poor in protein such as rations based on straws and stovers.

34.6.20 The protein content of oilcakes as also the amino acid make-up of the protein depends on the oilseeds used and the method of extraction. Depending on quality, quantity and palatability, the different oilcakes are used for different types of animals. In addition,

1 *Human Nutrition vis-a-vis Animal Nutrition in India*, 1954. Indian Council of Agricultural Research, New Delhi.

2 Report of the Committee on Livestock Feeds and Fodders. 1974. pp. 9-10 Ministry of Agriculture and Irrigation, New Delhi.

some oilcakes may contain (or develop) substances which are injurious to livestock such as aflatoxin in groundnut cake, gossypol in cottonseed cake and thioglucoside in rapeseed cake. The oilcakes should be freed from these toxic substances, where possible, before feeding livestock with them. Or else, oilcakes obtained from toxin free seeds should be used. The soyabean oilcake is palatable and its proteins are of high quality. This is, therefore, used extensively for poultry feeding. The cakes from castor, *mahua*, *neem*, tobacco and tung seed are of low palatability and may be harmful for livestock feeding due to the presence of incriminating factors. These are, therefore, not used or used only in very low proportion for feeding livestock and are used mostly as manures. Recent studies have shown that some of these cakes like *mahua* and *neem* can be utilised for feeding livestock after proper processing.

34.6.21 Oilcakes are broadly of three types with reference to the methods of extraction, namely, *ghani*, expeller and solvent extracted cakes. *Ghanis* leave too much of oil in the oilcake, which is not desirable in view of the shortage of oils and fats for human consumption in the country. *Ghani* oilcakes may be used by the solvent extraction plants or expellers for further extraction of oil. *Ghanis* provide employment in the villages and should continue in use wherever economically viable. No protection is required to be given to *ghanis* so far as feeding of cakes to animals is concerned.

34.6.22 Solvent extraction plants are of batch or continuous type and use edible grade of hexana as the solvent. They mostly extract oil from the *ghani* and expeller cakes and rice bran. As solvent extracted cakes contain less oil, they are cheaper sources of protein than unextracted cakes. Extraction leads to greater availability of vegetable oils for other uses. For these twin reasons, the solvent extraction of oilcakes should be encouraged as a national policy and there is considerable scope yet for doing so. Vigilance should, however, be exercised to enforce that solvents carrying harmful residues in cakes are not used for extraction. The alternative uses of oilcakes are as manure and as human food after refining. The availability of nonedible cakes is quite high as is shown in Appendix 34.3. We recommend that the constituents in these cakes which cause harmful effects may be identified and commercially feasible methods devised for making these cakes suitable for inclusion in rations for livestock. This will improve the economy of the oil industry and will at the same time increase the availability of much needed nutrients for livestock production. Similar studies may be carried out for minor oilcakes.

34.6.23 Processes have been developed for the preparation of protein isolates or other preparations which can be consumed directly by man

from copra cake, groundnut cake and soyabean meal. The processes have not yet been adopted on a large commercial scale. When industrial plants are set up for this purpose the wastes from these industries should be used for livestock feed.

34.6.24 Soyabean production in India is currently not appreciable but is expanding. Soyabean cake is an important item of animal feed because of high biological value of its protein. It is exported from USA in large quantities for livestock feeding to Europe. Increase in area under soyabean in India will be advantageous for livestock industry as soyabeans have high yield per hectare and contain higher percentage of oil and protein than other legumes. We, therefore, recommend that extension efforts should be directed towards increasing the area under soyabean.

34.6.25 Pulses and their byproducts as livestock feeds : Gram and *guar* have been used extensively for feeding livestock in the past. However, due to shortage and high price, though substantial quantities of pulses are being produced, the amount available for livestock feeding is insignificant.

34.6.26 Groundnut and soyabean are two legumes that are rich in oil and are used for oil extraction. The cakes are fed to livestock and poultry. In addition to cakes from oil bearing legume seeds referred to above, the byproducts available from legumes are *chunis* or husks which consist of the seed coats with some broken grains obtained in the milling of the legume seeds. The nutritive value of these pulse byproducts depends on various factors particularly on the amount of crushed grain contained therein. The husk itself is very poor in nutrients. The proportion of crushed grains in the *chunis* is progressively decreasing with improvement in equipment and technology. In Chapter 11 on Supply Possibilities we have indicated that in 2000 AD, the availability of pulses is expected to be 35.00 million tonnes. Assuming that *chunis* form 12 per cent of the total pulses, 4.38 million tonnes of *chunis* should be available in that year.

34.6.27 Fishmeal as livestock feed : Fishmeal occupies a prominent place amongst the ingredients for compounded livestock feeds in other developed countries particularly for poultry and pig feeds. In India there is great demand which is not yet met from good quality fishmeal. It is used to the extent of 5 to 10 per cent in the rations of poultry and pigs. On the basis of present estimates of the feed requirement for improved poultry and pigs only, the demand should be 70,000 tonnes annually. The estimated annual production is 20,000 tonnes part of which being of inferior quality, is being used as manure. In future the number of improved poultry

and pigs will increase rapidly, so it is recommended that steps should be taken to augment the production of good quality fishmeal at a reasonable cost.

34.6.28 India's production of quality fishmeal is negligible and is also in demand for export. The slow development of the industry is due to irregular supply of surplus fish and the difficulty of organising collection of raw material at ports of production at comparatively cheap rates. The subject has been discussed in detail in Chapter 40 on Marketing of Fish and Fishery Products.

34.6.29 We would like to reiterate that the setting up of small sized rotary fishmeal plants developed by the Central Institute of Fish Technology for processing surplus and inedible fish and fish wastes at landing centres on the Indian coast into fishmeal should be encouraged preferably in the cooperative and small scale sectors.

Fish Oils

34.6.30 Fish oils are divided into two categories—liver oils and body oils. Liver oils are rich in vitamins A and D and are useful for livestock feeds. The important sources of liver oils are sharks, skates and rays, oils from the latter two being poorer in vitamin D. Vitamin A supplements are required in feeds based on dry fodder. Whereas poultry and pig feeds require vitamin D supplement, feeds for cattle buffaloes and other livestock do not generally require to be fortified with vitamin D supplements. For livestock feeds the fish oils should be free from strong smells and may be protected against rancidity by the addition of antioxidants which are not generally permitted in fish oils meant for human consumption.

34.6.31 Demands for fish liver oils as source of vitamins are not expected to grow in years to come since synthetic vitamins are much cheaper. However, the use of these oils may help in reducing the dustiness of poultry mashes and for adding energy to the total rations.

34.6.32 Byproducts of animal origin: Meat byproducts used for livestock feeding come from slaughter houses, meat canning plants and from fallen animals. The total production from these sources in India at present is an insignificant proportion of the total livestock feed resources. This is due to the unorganised state of slaughter houses, absence of a well organised meat canning industry and lack of facilities for collection and processing of fallen animals.

34.6.33 These animal byproducts are high in protein generally of high quality. These products can contribute greatly to the animal feed resources of the country particularly through the compounded livestock feed industry. Ways and means of increasing production

of these valuable feeds have been discussed in Chapter 36 on Meat Production and Animal Byproducts.

Nonconventional Feeds and Feed Additives

34.6.34 Kitchen waste : Another source from which large quantities of animal feeds are likely to be available is the kitchen wastes from large hotels, messes, and catering establishments set up by Railways, Indian Tourist Development Corporation, Airlines, teaching institutions and private concerns. This source has not as yet been tapped systematically for use as livestock feed. Ways and means should be developed by State Animal Husbandry Departments to ascertain the availability of kitchen wastes from various sources and to study the economics of using this as livestock feed through feed compounding factories or for feeding it with or without processing to pigs.

34.6.35 Byproducts of the sugar industries : The principal sugar industry byproducts of importance in livestock nutrition are molasses and bagasse. The production of molasses and bagasse in India for past four years is given in Table 34.8.

TABLE 34.8

Production of Molasses and Bagasse in India¹

					(million tonnes)	
					Molasses	Bagasse
1969-70	.	.	.	.	2.00	14.77
1970-71	.	.	.	.	1.62	12.40
1971-72	.	.	.	.	1.20	9.90
1972-73	.	.	.	.	1.50	10.50

34.6.36 The principal value of molasses lies in its high palatability and as a source of readily available energy to the livestock. Because of this quality it can be used for improving the palatability of coarse fodders and other feeding stuffs. Addition of urea to molasses improves the overall nutritive value of the feeds which can form maintenance ration for adult bovines. Liquid urea molasses mixtures with limited amount of fodder and intact protein added as cakes can be used for the fattening of animals.

34.6.37 Molasses are generally in short supply for animal feed, it being used principally in the fermentation industries for production of alcohol and yeast. As a consequence, the price and utilisation of molasses are controlled in all the States. Allotment of molasses

¹ Report of the Committee on Livestock Feeds and Fodders, 1974. Ministry of Agriculture & Irrigation, New Delhi.

for livestock feeding is very inadequate and is about 2 per cent of the total production. Because of the importance of molasses in livestock feed industry which is unable to compete with other more lucrative industries using molasses we recommend that the supply of molasses to livestock industry at reasonable rates should receive adequate support.

34.6.38 Bagasse has little nutritional value but can be used as filler in animal feed during scarcity periods and when coarse roughages are in short supply. Studies¹ conducted at the IVRI have shown that bagasse supplemented with 10 per cent molasses and 1 per cent urea can form a maintenance ration for the cattle.

34.6.39 Sugarcane tops: Sugarcane tops can be fed to cattle immediately after harvesting or after ensiling. Containing only 1 per cent protein they are not a very nutritious fodder but are a good source of energy. It has been calculated that in 1973-74, 66 million tonnes of tops were available but only a small portion was utilised for cattle feed, the entire quantity being used as fuel. In 2000 A.D. the production of sugarcane tops may be around 100 million tonnes. The possibility of enriching it with urea should be studied in the context of profitably utilising it for animal feeding. A process² has been developed for derinding sugarcane and mixing it in small proportion with sugarcane tops for livestock feeding. Similar studies in India including economic feasibility should be undertaken. Educative propaganda in this direction is necessary, so that this vast resource for feeding livestock is not misused.

34.6.40 Minerals, vitamins and other additives: The feed compounding factories obtain mineral mixtures, vitamin supplements, antibiotics and other feed additives for livestock feeds from other industries. Without these it would be difficult to balance the mineral requirements particularly for high producing animals or animals in areas that are deficient in particular minerals. Addition of antibiotics and additives like coccidiostats decreases the incidence of diseases, improves rates of growth and efficiency of production.

34.6.41 The present production of mineral mixtures, vitamin supplements and other additives in India is not adequate for meeting the demands of the organised sector of animal production industries. The reasons for the shortfall are the non-availability of ingredients from local sources, shortage of foreign exchange and high cost of raw materials. The principal raw material that is available in limited quantities is sterilized bonemeal or other sources of digestible and

1 *Feeding Animals During Scarcity Periods*. 1973. Animal Nutrition Division, Indian Veterinary Research Institute, Izatnagar, U.P., India.

2 Pigda W.J. 1974. *Derinding sugarcane as an animal feed—A major breakthrough*—World Animal Review No. 11 p. 1-5. Food and Agriculture Organisation, Rome.

assimilable phosphate. We recommend that some livestock feed manufacturers in the public, private and cooperative sectors should develop resources of scarce materials including sterilised bonemeal. Action may be taken by the State Governments under provisions of laws relating to the pharmaceutical industry, foods and other commodities, for procurement of the raw materials etc. at reasonable cost.

34.6.42 There is a great possibility of fortifying poultry and swine rations with essential amino acids like lysine and methionine. Added to the mashes/meals of vegetable origin they augment the biological value of the proteins and minimise the need of incorporating animal proteins. As these are not manufactured in India their imports should be permitted for the organised feed industry. At the same time the possibility of economically manufacturing, these amino acids for man and animal in the country should be examined.

34.6.43 Non-protein nitrogen (urea, ammonium salts etc.): Urea of the feed grade as distinct from the fertilizer grade and is used extensively as a protein substitute particularly for meat animals like beef cattle and fattening sheep in other developed countries where protein feeds are expensive. Urea offers no advantage where protein is cheap or plentiful in a ration containing, say, *berseem*, oilcakes etc. Studies at the IVRI and the NDRI have indicated that urea can be used as a protein substitute for ruminants in two ways. One for enriching poor quality fodders and the second as an additive in the concentrate mixtures. It must be used along with a ready source of energy such as sugar, molasses or grain flour. These ingredients supply the rumen microorganisms sufficient energy to convert the ammonia from urea to protein of food biological value which is later used by the host animals for better nourishment. Another precaution which is essential is that urea must be carefully and thoroughly mixed in the feed to avoid excessive production of ammonia in the rumen which can be toxic to the animal.

34.6.44 Urea can greatly reduce feeding cost resulting in great economy in the cost of production of milk, meat and wool. We, therefore, recommend that :

- (i) arrangements should be made for the manufacture of feed grade urea in India ;
- (ii) the compounded livestock feed manufacturers should be asked to use urea in feeds other than those for poultry, pigs, equines and laboratory animals. The Indian Standards Institute (ISI) has recommended 1 per cent use in concentrate for ruminants. The cost of production and sale price should be calculated and fixed on this basis.

The feed manufacturers should be allotted the quota of molasses at controlled rates from sugar mills on the basis of feed manufactured by them; and

- (iii) the method of using urea for enrichment of straws and stovers should be popularized extensively particularly in intensive milk, meat and wool production areas and arrangements should be made in these areas for the controlled supply of suitable molasses at reasonable rates.

34.6.45 Calf starters : A substantial portion of the total milk produced in the country is used for calf feeding. As milk is so urgently needed for human use, steps must be taken to reduce its use for calf feeding without affecting survival of the calf, its growth and maturity. Studies¹ conducted at the IVRI and the NDRI on calf starters have shown that with milk substitutes considerable economy can be effected in the total milk fed to a calf till the weaning age. These calf starters are so formulated that they fulfil the nutritional requirements during the development of the rumen in this period. This system of rearing calves is economical and has proved to be an asset in the case of crossbred calves. The limited milk yield of indigenous dams is not sufficient to support the nutritional requirements of its crossbred calf.

34.6.46 At present, very small quantities of commercial calf starters are being manufactured by the livestock feed manufacturers as feeds for compounding calf starters are scarce and their prices are high. To make increasing amounts of milk available for human use, we recommend that introduction of commercially compounded calf starters, particularly in milksheds of dairies in the public, private and the cooperative sectors, should be encouraged. This may also be done in Intensive Cattle Development Projects. The production and sale of compounded calf starters may be assisted and supported by the State/Central Governments, at least during the first five years till they become popular. Strict quality control according to ISI standards should be enforced.

34.6.47 Other byproducts : A large number of other byproducts, which have at present limited use, can eventually be used as sources of nutrients for livestock. These include the following :

- (i) Forest byproducts like sal seed and sal seed cake, *mahua* flowers and *mahua* cake, rubber seed cake ;
- (ii) tapioca meal and other byproducts of tapioca ;
- (iii) seeds of mango, *jaman* and other fruit and vegetable by-products ;

¹ Ranjhan S.K., et al 1972. Effect of limited milk intake on the growth of crossbred calves upto 3 months of age—*Indian Journal of Animal Science* 42 (10) 754.

- (iv) wastes from silk, tannery, frog-legs and other similar industries;
- (v) poultry litter and cow dung;
- (vi) proteins from leaves, single cell protein from petrochemical industry and algae;
- (vii) wastes from antibiotics industry; and
- (viii) sea weeds and other products from the sea.

34.6.48 Most of the above byproducts are at present not utilised or inadequately utilised and hence are available at cheaper rates. These can be fed to the livestock as such with minor precautions or after a little processing. Studies on the utilization of these and other wastes are in progress under a coordinated project of the ICAR and also at several research institutes and agricultural universities. These studies relate to the identification of wastes available at cheap rates in adequate quantities, determination of their chemical composition and their nutritive value and development of methods, if needed, for processing to remove toxic substances, if any, and of methods of feeding different types of livestock in combination with other feeds. These studies are at different stages of progress and should be completed expeditiously. Newer sources should be similarly identified and developed for utilization.

34.6.49 The results of research in this field so far undertaken have been well utilized by compounded livestock feed manufacturers particularly with regard to sal seed cake, silkworm pupae, rubber seed cake, wastes from antibiotic industry, and tapioca meal. In 1973, about 60,000 tonnes of deciled sal seed meal was utilized in the organised sector. Other products have not yet found extensive use for want of extension effort in some cases and in others due to such factors as high cost of collection and processing of the waste. We recommend that in utilizing byproducts from non-conventional sources, greater coordination between the technical officers in the intensive livestock production projects, extension officers in animal sciences, compounded livestock feed industry and the research scientists should be urgently developed.

34.6.50 We would like to make special mention regarding the studies being conducted in the country and abroad for the utilization of leaves of cultivated plants, forest trees and other sources for production of protein rich foods for human beings. Studies are also being made on the utilization of crude oil for growing microorganisms to be used ultimately for direct human consumption. At some intermediate stage however, the product can be definitely used to augment animal feeds. This aspect of the development should, therefore,

be kept in view. (cf. Chapter 9 on Nutrition).

Algae

34.6.51 Algae can be easily grown on sullage or in stagnant waters in fields, marshes etc. They are about 1,000 times more efficient than other plants in utilising sunlight for production of plant material. Algae being rich in protein, studies have been made recently to determine their commercial feasibility as a source of food for men, animals and as manure. Palatability and digestibility of algae are no doubt poor but its low cost of cultivation is in its favour. We have been informed that in Hungary the process has been commercially developed to use algae for cattle feed production. We recommend that studies on the potential use of algae for food, feed and manure (Chapter 48 on Fertilisers and Manures) may be taken up at research institutes including the Indian Agricultural Research Institute and IVRI.

34.6.52 Sea weeds : India has got a vast coast, portions of which contain large quantities of sea weeds. Some varieties of sea weeds like sorgossum have got good feed value but as yet have scarcely been utilised due to difficulties of collection, transport and processing. The manufacture of agaragar and alginates from sea weeds usually leaves a lot of material as waste product which is rich in minerals and can be used in livestock rations in place of mineral mixtures. We are, therefore, of the view that projects to work out the technical and economic possibilities of processing sea weeds for animal feeds should be formulated. The ICAR may examine this possibility.

34.6.53 We are firmly of the view that unless the recommendations made above for bridging the widening gap between the requirements of feeds for balanced rations and the availability of feeds are given effect to it will not be possible to increase livestock productivity and to reach the targets either in agricultural production, production of milk, meat, eggs and wool or in attainment of human health both mental and physical. Emphasis should be laid on all aspects of the problem—limitation of requirements, greater feed production and more efficient utilization of the available feed resources. A livestock industry organised into cooperatives of producers will be a great help in this direction. Development of agro-industries particularly a healthy compounded livestock feed industry will be of great help. The most essential factor will be the economics of livestock keeping and manufacture of products in competition with other uses of land, labour and capital. We hope these factors will be in favour of livestock production.

7 COMPOUNDED FEED MANUFACTURING INDUSTRY

34.7.1 It is not often possible for lay farmers and workers at farms to formulate economical and well balanced concentrate mixtures even when they have the necessary education and training. Different mixtures have to be compounded for animals of different species, ages and at different stages of production. Again, different types of concentrate mixtures are required according to the nature of the roughage fed to the animals. For example, with legume, forages, a low protein concentrate is to be fed and with poor quality roughages protein rich concentrate mixtures have to be fed. Farmers generally give only one feed like gram or barley or mix a few in the same proportion for all livestock and poultry. This indiscriminate use of concentrate feed can be avoided provided readymade compounded feeds of different types to suit the requirements of various categories of animals are made available to suit the farmers' convenience.

34.7.2 Particle size of feeds is important for handling and for digestion. It is well known that crushing of grains before feeding is essential for the proper utilization of the nutrients present. Too often the grains and other components of the mixture are ground to make powder or fed without adequate crushing so that there is a lot of wastage during handling, storing and feeding animals. Many seeds are not fully digested and are voided in the faeces almost as such. This can be avoided if the compounded concentrate mixtures are available in pelleted mash form.

34.7.3 Though ruminants can subsist on rations consisting mainly of forages yet feeding of some quantities of concentrate mixtures helps better utilization of the end-products of rumen fermentation for milk or meat production. Here again, suitable compounded feeds can be of great help to the livestock owner. The convenience in use and saving in labour are additional advantages that are available to the commercial dairymen, poultry keepers and the small holders who keep animals as a subsidiary occupation.

34.7.4 The compounded feed industry can utilize agro-industrial byproducts as well as slaughter house wastes as raw materials which cannot normally be so used because individual livestock owners cannot either obtain the byproducts or process them for feeding. It may be unsafe for individual livestock owners to use nonprotein nitrogen substances as ingredients in concentrates as this requires precautions in handling and mixing. It is through this industry that minerals, vitamins, and feed additives like antibiotics required in very small quantities can be mixed thoroughly. The advantages of purchase in

bulk at harvest when prices are the lowest and mass storage with proper precaution against damage or deterioration are obvious, but this is possible only when purchase is made commercially or cooperatively.

34.7.5 In the light of the above observations it will be clear that enormous benefits can be reaped by a well established, organised extensive feed compounding industry. Yet factories established so far are supplying only a small percentage of the total concentrates required even for the organised livestock industry. The annual installed capacity (1973) of the factories was about 1,253,000 tonnes of compounded livestock feeds (300 days 3 shift basis) ; but only 1/3rd of this capacity is reported to be utilised. This is very small compared with the estimated total need of about 20 million tonnes in 1973. This is in spite of the fact that the industry is exporting a portion of the manufactured feed to other countries like Poland, Dubai, U.K. and Yugoslavia.

34.7.6 The low utilization of the installed capacity is mainly due to the unawareness of the consumers regarding the advantages of the compounded feeds. Further, as has been stated earlier, concentrate feeds have not so far been used to any great extent due to the poor productive capacity of indigenous animals in general and lack of remunerative market. Mostly the sales of animal products are distress sales and not sales of commercial products for profit. In the absence of profit motive, owners do not invest in purchased feeds. With a progressive increase in the number of improved livestock and the development of commercial outlets for animal products, we expect that the feeding of concentrates will become more popular and the advantages for balanced feeds for such improved animals will eventually become evident to animal owners. Therefore, in spite of the present gloomy picture we feel there is a huge potentiality of not only maintaining but also expanding the use of compounded feeds for livestock feeding. All efforts must be made by the State Animal Husbandry Departments, extension workers, panchayats, cooperatives and other organisations interested in the welfare of livestock to popularise feeding of concentrates and allow the compounded feed industry to expand its production. This may be done through educative propaganda, demonstration and incentives. There should also be close liaison between these organisations and the compounded feed industry in public, cooperative and private sectors, so that feeds of high quality are offered at reasonable prices.

34.7.7 The question of economics of using compounded feeds under village conditions revolves mainly on the price structure of feed con-

stituents and the proportions in which they are compounded. No systematic studies have been initiated by any of the feed manufacturing concerns except the Kaira District Cooperative Milk Producers' Union to show the efficiency of the compounded feed over home made traditional mixtures. It is necessary that such studies on comparative economics should be carried out in different parts of the country. At the same time manufacturers and research institutes should collaborate to find more economic mixtures without any sacrifice of nutritive value for productive purposes.

34.7.8 In order to popularize the use of compounded balanced livestock feeds for productive animals and also calves and other young animals of improved breeds which are not producing but are future producers, adequate incentives should be given to the consumers. These incentives may be essential in the first few years when the compounded feeds are introduced in an area. In other words, production and consumption of balanced livestock feed mixtures based on maximum use of by-products should be developed in a coordinated manner. The Departments of Animal Husbandry should be allotted this responsibility and should be given necessary facilities by way of staff and funds to fulfil this responsibility in collaboration with animal nutritionists, food industries and animal breeders.

34.7.9 The question of quality control of the manufactured product should be given the highest priority. The ISI has formulated various standards for concentrate mixtures suitable for various categories of cattle, poultry, pigs etc. We understand these standards have not been adopted by the feed compounding industry, the reason being that there is no quality control on the feed ingredients used for compounding feed mixtures for cattle and poultry. We have recommended in paragraph 34.8.8 that necessary legislation for adopting the ISI specifications for feed ingredients should be enacted. When this is done the feed manufacturers should have no difficulty in adopting the ISI standards. We consider it essential that ISI standards should be adopted by the feed manufacturers which will be a safeguard for the consumers engaged in livestock production. State Animal Husbandry Departments should have laboratories where any producer, purchaser or seller can get an independent analysis done of his samples on payment. This laboratory may also be used for simple feeding trials in feed stuffs and mixtures for various purposes.

8 FURTHER SUGGESTIONS

34.8.1 Exports of oilcakes : At present exports of oilcakes and

other animal feeds are being encouraged, in many cases by subsidies and concessions. These animal feeds are required within the country for increasing production of milk, eggs, meat and wool. Some of these products are imported at higher cost. The policy of exporting the raw materials and of importing animal products particularly milk has been reviewed by us separately (See Chapter 12 on Export Potentialities and Import Substitution).

34.8.2 The quantities of livestock feeds exported are shown in Table 34.9. The total quantities of concentrate feeds including oil-cakes, brans, guarmeal, fishmeal etc. have been shown yearwise for the last three years.

TABLE 34.9

Exports of Livestock Feeds

Year	Quantity (thousand tonnes)	Value (Rs. crores) all in foreign exchange
1970-71	987	61.74
1971-72	836	52.87
1972-73	712	43.68

It may be pointed out that while substantial quantities of feed ingredients are being exported every year, the country is importing milk products from abroad.

34.8.3 It can be seen that even the year 1972-73 when 712 thousand tonnes of cattle feed was exported, this quantity could have been converted into 1.78 million tonnes of milk, assuming that by feeding cows with 1 kg of concentrate mixture over and above maintenance ration 2.5 kg of milk can be obtained. This taking even the modest value of Re. 1 per kg of milk, 178 crores of rupees worth of milk would have been produced.

34.8.4 We had pointed out in Chapter 12 on Export Possibilities and Import Substitution that if the cattle feed is used within the country, the internal production of dairy products will go up. This will help in import substitution and may eventually lead to exports of dairy products. We would, however, like to point out that mere ban on export of cattle feed will not automatically lead to enhancement of milk production within the country. For enhancement of milk production the livestock feeds diverted from the export quota should be fed to the high quality stock which would be able to convert this feed efficiently into milk. This will again entail adequate organisational

arrangements for distribution from the centres of feed production to areas of intensive milk production. We have discussed the various issues connected with the milk enhancement programmes in details in our Interim Report on Milk Production through Small & Marginal Farmers and in Chapter 28 on Cattle & Buffaloes.

34.8.5 If our recommendations made in the above mentioned Interim Reports and Chapters are implemented, the producers will be able to possess better quality stock and will be able to obtain all the inputs like feeds and fodder, animal health care, breeding services including artificial insemination available to them without difficulty through the farmers' cooperative societies/organisations. In a situation like that the farmers would be in a better position to purchase the feeds and make best use of them for conversion into milk, meat and other livestock products.

34.8.6 What we have stated above with regard to feeding of dairy cattle will also apply in principle in the case of feeding of sheep and goats, poultry, pigs etc. The organisational arrangements necessary for enhancing production of these livestock are discussed in our Interim Report on Poultry, Sheep & Pig Production through Small and Marginal Farmers and Agriculture Labourers for Supplementing their Income and in Chapters 31, 30 and 32 on Poultry, Sheep and Goats and Other Livestock.

34.8.7 If some quantity of the feed which is being exported at present is diverted for judicious feeding of these livestock, there is bound to be an increase in their production. It may then be possible to export some of the additional products, particularly meat for earning foreign exchange, thereby offsetting the loss of foreign exchange through reduction in the exports of feeds. Here again, as we have stressed in Chapter 12, the economics of export of feed vis-a-vis export of livestock products will have to be carefully gone into.

34.8.8 Quality control : The byproducts sold as ingredients for compounding concentrate mixtures are often found to be adulterated. Lot of husk is often introduced into oilcakes and brans either inadvertently by unskilled manufacturers or intentionally by unscrupulous traders. Fortunately, specifications for most of these ingredients used conventionally as livestock feed have been formulated by the ISI, so that the purity of any marketed product can be easily checked. There is, however, no legislation to prevent adulteration of livestock feeds. We, therefore, recommend that suitable legislation on the lines of Food Adulteration Act may be enacted to cover animal feeds. State Animal Husbandry Departments may also set up animal nutrition laboratories at divisional levels to analyse feeds commonly sold in the

market so as to keep a control on the quality of such materials.

34.8.9 Practically no work has so far been done to find out the biochemical pathways in which the feed nutrients are utilized for growth and production of milk, eggs, wool etc. We recommend that studies in this direction should be initiated so that the interaction of different metabolites on ultimate production levels could be understood, which in turn will help to determine the specific nutrient requirements of economic traits.

34.8.10 The magnitude of the complex problem of livestock feeding makes it imperative that research and developmental activities in this field should be greatly strengthened. In our opinion, it is necessary that every State Animal Husbandry Department should have an officer at a fairly high level to coordinate work of livestock feed production, procurement, compounding and distribution. This officer should also be responsible to popularise through extension programmes the latest research findings in the field of scientific feeding for higher production. In order to coordinate the work of the State Animal Husbandry Departments in the field of livestock feeding, there should be a specialist on Animal Nutrition in the Animal Husbandry Division of the Union Ministry of Agriculture & Irrigation. It is also necessary that for coordination of the research activities in the field of animal nutrition at the various research institutes and veterinary and agricultural colleges, a scientist at a high level should be employed by the ICAR. The post of Assistant Director General should be created at the Headquarters.

34.8.11 Institute of animal nutrition research : Several recommendations made in this Chapter would involve considerable intensification of research in the field of animal nutrition and allied subjects. A proposal for the setting up of an Institute of Animal Nutrition was accepted during the Fourth Plan, although the proposal was later dropped. Since then the urgency for expanding research activities in this discipline has become all the more greater. Fundamental studies on rumen digestion and metabolism have to be undertaken. The requirements of amino acids and trace elements need special investigations. Work on the utilization of agro-industrial byproducts as livestock feed has to be intensified. The development of commercial livestock keeping and feed industries has improved the opportunities for practical application of the results of research. We, therefore, strongly recommend the establishment at an early date of an Institute for animal Nutrition Research. This Institute should work in close cooperation and coordination with the existing centres of animal nutrition research at ICAR/Institutes and agricultural universities.

9 SUMMARY OF RECOMMENDATIONS

34.9.1 The following is a summary of the important recommendations made in the text of this chapter.

1. Regions having soil conditions leading to deficiency of essential feed nutrients in feeds and fodders and regions having large quantities of toxic minerals should be identified and deficiencies or toxicities should be rectified.

(Paragraph 34.1.6)

2. Livestock feed resources must be greatly enhanced for increasing production of animal products like milk, meat, eggs, wool etc. and for properly maintaining the animals for efficient draught purposes.

(Paragraphs 34.1.7, 34.4.2 & 34.6.53)

3. The young ones of improved animals and crossbreds have higher food requirements. They should be provided with extra feed like creep feed and milk substitutes.

(Paragraphs 34.2.1, 34.2.6, 34.2.8 & 34.6.45)

4. Studies should be carried out to determine the optimum nutrient requirements and feeding level under different physiological conditions for production of work, meat, milk, eggs and wool. These studies should be updated every five years, compiled and published as a guide for scientific and economic feeding of livestock.

(Paragraph 34.2.13)

5. Area and yield data in respect of different fodder, cereal and cash crops should be collected.

(Paragraph 34.3.6)

6. Studies should be undertaken by the Institute of Agricultural Research Statistics to develop standard methods of estimation to evaluate total feed availability and requirements of feeds.

(Paragraph 34.3.11)

7. Efforts should be made to decrease livestock numbers by using available stock more efficiently—sharing bullocks, reducing unproductive periods and increasing breeding and productive efficiency. Efficiency of feed utilisation can also be increased by improvement in feed handling and feeding practices particularly by feeding balanced rations.

(Paragraph 34.4.5)

8. Available feeds should be used for feeding of productive animals and their followers. All the unproductive animals should be progressively eliminated.

(Paragraph 34.4.5)

9. Restrictions on grazing and/or levying of progressively heavier

charges on 'free' grazing should be introduced as a means for the elimination of uneconomic cattle and other livestock and for improvement of pasture yields through systematic grazing and scientific management of grazing lands.

(Paragraph 34.5.2)

10. In the selection of grasses, trees and bushes for control of soil erosion, their possible feed value should be given due consideration.

(Paragraphs 34.5.3 & 34.5.8)

11. Pastures and grazing areas owned by individuals or jointly by the community should be improved through controlled grazing and introduction of nutritious grasses and legumes and application of fertilizers.

(Paragraph 34.5.3)

12. In areas where intensive livestock production programmes are taken up, a study should be made of the cycle of growth, productivity and nutrient yield of the locally available natural grasses. The potential for improvement should be evaluated and action programme drawn up by teams including experts in grassland management, livestock development and agricultural economics.

(Paragraph 34.5.3)

13. Efforts should be made to rejuvenate and maintain productivity of overgrazed pastures and to increase utilization of presently under-utilized pastures and grazing areas due to inaccessibility.

(Paragraph 34.5.4)

14. There should be coordinating bodies in the State headquarters consisting of heads of Departments of Forest, Sheep Development, Animal Husbandry, Dairy Development and Agriculture for planning conservation and utilization of grasslands and hay and for reviewing the progress of Plans. Similar committees will be necessary at district level.

(Paragraph 34.5.8)

15. Cutting of grasses from inaccessible areas (as opposed to grazing by animals) and its storage in fodder banks should be encouraged. Concessions should be given for the transport of baled hay from rail-heads to rural areas of intensive livestock production. These concessions should not be available for urban areas.

(Paragraphs 34.5.4 & 34.5.19)

16. Research for evolving high yielding varieties of fodder grasses and legumes and for development of cultivation practices so that higher economic returns can be obtained for land, capital and labour used for fodder in comparison with other uses of land should be intensified.

(Paragraphs 34.5.11 & 34.5.13)

17. In areas where intensive livestock production is taken up,

cultivation of fodder should be encouraged by educative propaganda, advice, supply of seed materials and fertilizers.

(Paragraph 34.5.13)

18. Silage making from seasonal surplus of fodders grasses and other plant material may be adopted by large cooperatives of milk producers or producers of other livestock products on a cooperative basis.

(Paragraph 34.5.20)

19. In hilly areas where surplus grass is available and conditions for hay and silage making are not favourable, artificial drying of forages may be practised. Feasibility studies regarding the economics of such enterprise may be conducted by the IGFRI, and agricultural universities.

(Paragraph 34.5.20)

20. In each intensive livestock production project, a survey of feeding practices should be conducted to minimize waste and to utilize nutritive fodders more efficiently. An animal nutrition officer should be employed for each major intensive livestock project.

(Paragraph 34.5.22)

21. While selecting varieties of foodgrains for extensive cultivation, special varieties with high yield of total nutrients for livestock feeding should be given due importance.

(Paragraph 34.6.7)

22. Research and extension on high yielding coarse foodgrains should be intensified.

(Paragraph 34.6.7)

23. Improved milling of rice should be popularised to make rice bran of suitable quality available for feeding animals.

(Paragraph 34.6.12)

24. As solvent extracted rice polishings have better keeping quality and can be used for livestock feeding, the extraction of rice polishings for recovery of oil should be encouraged.

(Paragraph 34.6.13)

25. Proper processing of byproducts for feeds should be made a condition for licensing of food industries so that suitable byproducts in larger quantities are made available for feeding of livestock. Feasibility studies should be carried out to determine the economics of taking over the raw byproduct by the compounded feed industry for further processing and use.

(Paragraph 34.6.16)

26. Feeding of cotton seed should be discouraged through educative propaganda. It should be replaced with cotton seed cakes and other cheaper substitutes for saving oils for other use. The substitutes

or compounded feeds should be provided to the users at reasonable costs and in adequate quantities.

(Paragraph 34.6.17)

27. Research should be initiated to identify the harmful substances in non-edible oilcakes and other byproducts and to devise commercially feasible methods for making these cakes suitable for livestock feeding.

(Paragraphs 34.6.20 & 34.6.22)

28. Solvent extraction of oil cakes should be encouraged to increase availability of oils and decrease cost of cakes as livestock feeds. Vigilance should, however, be directed to enforce that solvents carrying harmful residues in cakes are not used for extraction.

(Paragraph 34.6.22)

29. Soyabean cake is of high value for livestock feeding. Soyabean production should be encouraged.

(Paragraph 34.6.24)

30. Improved methods of processing inedible fish and fish industry wastes into fish meal including the setting up of small sized rotary fish meal plants developed by the Central Institute of Fish Technology at fish landing centres and fish factories should be encouraged, preferably in the cooperative and small scale sectors.

(Paragraphs 34.6.28 & 34.6.29)

31. The State Animal Husbandry Departments should ascertain the availability of kitchen wastes from large hotels, messes, catering establishments set up by the tourist corporations, airlines, teaching institutions and private concerns. The economics of their use as livestock feed with or without processing should be studied.

(Paragraph 34.6.34)

32. Molasses should be allotted to the livestock industry in adequate quantities at reasonable rates for enriching feeds and fodders with urea and for pelleting feeds.

(Paragraph 34.6.37)

33. The use of sugarcane tops as livestock feed should be encouraged. Research on processes like derinding of canes for use as feed should be undertaken.

(Paragraph 34.6.39)

34. Reasons for the inadequate availability of bone meal and other ingredients for mineral mixtures and additives for balanced livestock feeds should be studied. The livestock feed manufacturers in the public, private and cooperative sector should develop resources of these scarce materials. The State Governments may utilise provisions in the existing laws for making scarce raw materials available to the compounded livestock feed industries at reasonable cost.

(Paragraph 34.6.41)

35. Import of lysine and methionine should be allowed so that these amino acids can be added to poultry and pig rations. The pharmaceutical industry should be encouraged to manufacture these essential amino acids within the country.

(Paragraph 34.6.42)

36. Arrangements should be made for the manufacture of feed grade urea in India and popularizing its correct use for feeds and fodders.

(Paragraph 34.6.44)

37. To minimise the cost of production of compounded feeds for ruminants, one per cent urea should be incorporated according to ISI recommendations.

(Paragraph 34.6.44)

38. In order to make more milk available for human consumption, use of calf starters should be popularised. Compounded feed manufacturers should be encouraged to manufacture calf starters and creep feeds.

(Paragraph 34.6.45)

39. Even in 2000 A.D., the production from conventional sources may not be sufficient to meet the total requirement of feed constituents. As such, other unconventional byproducts from slaughter houses, fallen animals, distillery wastes, caning industry, starch industry, forest byproducts, sea weeds, algae etc. which are not utilized or inadequately utilised, should be exploited for augmenting feed resources. Research on this aspect both in the laboratory and field and extension programme should be intensified on a continuing basis.

(Paragraphs 34.6.47 to 34.6.52)

40. Studies should be undertaken to evolve more economical balanced feeds for livestock without any sacrifice of nutritive value for productive purposes and to compare the economics of these rations with traditional methods of feeding livestock in different parts of the country. Sufficient incentives during the first few years should be provided to livestock owners so as to encourage them to change over to balanced compounded feeds particularly for improved animals and their growing youngstock.

(Paragraphs 34.7.6 & 34.7.7)

41. State Animal Husbandry Departments should have laboratories where feed samples can be got analysed by the producer, seller or purchaser.

(Paragraph 34.7.9)

42. The livestock feed diverted from export should be fed to high producing livestock. For this purpose an efficient organisation should be built up for transfer of feed from places of production to areas

of intensive livestock production.

(Paragraph 34.8.4)

43. The economics of export of livestock feed vis-a-vis export of livestock products should be studied so that loss of foreign exchange through diminished export of livestock feed ingredients may be made good to our advantage through the export of livestock products.

(Paragraph 34.8.7)

44. Legislation similar to that of Food Adulteration Act should be enacted and enforced to ensure that only feed materials and compounded feeds which conform to the quality standards are sold.

(Paragraph 34.8.8)

45. Biochemical pathways in which different nutrients are utilised for production of growth, milk, meat, eggs, etc. should be investigated to determine nutrient requirements for economic traits.

(Paragraph 34.8.9)

46. Every State Animal Husbandry Department should have an officer at a fairly high level to coordinate development and extension of livestock feed production, procurement, compounding and distribution.

(Paragraph 34.8.10)

47. In order to coordinate the work of the State Animal Husbandry Departments in the field of livestock feeding, there should be a Specialist on Animal Nutrition in the Animal Husbandry Division of the Union Ministry of Agriculture & Irrigation.

(Paragraph 34.8.10)

48. A post of Assistant Director General should be created at the headquarters of the Indian Council of Agricultural Research for coordination of research activities in the field of animal nutrition at the various research institutes and veterinary and agricultural colleges.

(Paragraph 34.8.10)

49. An Institute for Animal Nutrition Research should be established at an early date.

(Paragraph 34.8.11)

APPENDIX 34.1

Average Rates of Feeding of Concentrates Green and Dry Fodder Assumed for
Different Categories of Livestock and Poultry

(in kg)

1	Rates of feeding per day		
	Concen- trates	Green fodder	Dry fodder
2	3	4	
cattle			
1. crossbred (milch)	2.75	20.00	6.00
2. females over 3 years of age:			
(i) improved cows (milch)	1.20	10.00	6.00
(ii) other milch cows and not calved even once	0.125	3.5	3.16
3. males over 3 years of age	0.17	4.96	5.65
4. less than 3 years of age:			
(i) crossbred (young stock)	1.50	10.00	2.00
(ii) others young stock	0.016	1.58	1.47
buffaloes			
1. females over 3 years of age:			
(i) improved buffaloes	1.50	10.00	6.00
(ii) other milch buffaloes and those not calved even once	0.41	5.72	5.08
2. males over 3 years of age	0.109	6.51	5.43
3. less than 3 years of age	0.01	1.59	1.64
poultry			
(i) improved layers	0.123	0.020	..
(ii) growing stock	0.041	0.007	..
other livestock			
(i) improved sheep	0.274	..	0.40
(ii) improved pigs	2.50	1.00	..
(iii) horses and ponies	0.50	..	..

APPENDIX 34.2

Estimated Requirements of Feeding Stuffs for some Categories of Livestock in 1973

(million tonnes)

Species	Category	Projected population	Concentrates	Green fodder	Dry fodder
cattle	1. crossbred milch	1.00	1.005	7.300	2.190
	2. improved milch	5.50	2.410	20.075	12.045
	3. crossbred young stock	0.44	0.240	1.605	0.320
	4. others	172.00	7.200	213.910	238.400
	total cattle	178.94	10.855	242.890	252.955
buffaloes	1. improved milch	3.50	1.920	12.775	7.665
	2. others	54.4	4.340	87.700	77.290
		57.90	6.260	100.475	84.955
	total bovine		17.115	343.370	337.910
	layers	24.00	1.080	..	..
improved	growers	12.00	0.180	..	..
		36.00	1.260		
sheep lambs		0.40	0.300	..	3.000
goats kids		0.68	0.450	..	4.500
improved pigs		0.32	0.220	..	..
horses and ponies		0.96	0.220	..	2.000
			19.565	..	347.410

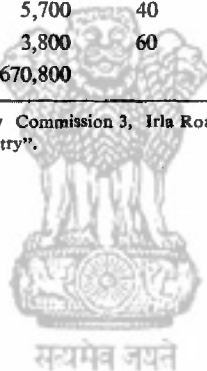
N.B. These requirements have been calculated according to the schedule as recorded by Ambler et al on the feeds which have actually been consumed by the livestock from the sample Surveys. This did not, however, take into account any grazing.

APPENDIX 34.3

Availability of Non-Edible Oil Cakes

Variety of non-edible oilseed	Seed Potential (Tonnes)	Oil yield (%)	Potential cake produced	Utilization of seeds (Tonnes)	Actual production of cake (Tonnes)
1. <i>Mahua</i>	490,000	35	318,500	71,428	48,571
2. <i>Neem</i>	418,000	20	334,400	100,000	80,000
3. <i>Karanja</i>	111,000	27	81,030	25,900	18,907
4. <i>Kusum</i>	90,000	33	60,300	9,900	6,633
5. <i>Sal</i>	5,504,000	12.5	4,816,000	25,000	48,875
6. <i>Khakan</i>	46,300	33	31,021		
7. <i>Kokum</i>	2,000	40	1,200	500	300
8. <i>Nahar</i>	5,700	40	3,420		
9. <i>Undi</i>	3,800	60	1,520		
total	6,670,800				

Source : Khadi and Village Industry Commission 3, Irla Road, Vile Parle West, Bombay, "Non-Edible Oil and Soap Industry".



ANIMAL HEALTH

1 INTRODUCTION

35.1.1 The urgent need to improve the animal health cover has been discussed in this Chapter. Livestock development programmes cannot possibly succeed unless and until a well organised animal health service is built up and protection of livestock against diseases and pests, particularly against the deadly infectious ones, is assured. This fact was appreciated by the Government of India as far back as 1868 when the Indian Cattle Plague Commission (ICPC) was appointed to report on the prevalent cattle diseases and to suggest measures for their prevention and control. On the recommendations of the ICPC, and of another Commission which functioned during 1882 and 1883, the Indian Civil Veterinary Department came into being in 1891. A major step taken in the development of animal health services was the establishment in 1889 of the Imperial Bacteriological Laboratory (IBL), the fore-runner of the Indian Veterinary Research Institute (IVRI).

35.1.2 At the time the IBL was started, rinderpest (cattle plague) was widespread among cattle and buffaloes in the country as a devastating scourge. Therefore, early researches in the Institute were mainly concentrated on rinderpest and by 1926 these efforts culminated in the successful adaptation of the cattle plague virus to goats and the production of a highly efficacious vaccine for immunizing cattle and buffaloes against this fell disease. These important researches paved the way for the launching of a countrywide programme to reduce the depredations caused by this plague. The IVRI also undertook studies on many other viral, bacterial and parasitic diseases of livestock, and developed effective methods and biological products for combating them. These researches made easier the tasks of the progressively expanding civil and military veterinary services, not only in their fight against the animal diseases but also in taking up positive programmes of livestock development. The Royal Commission on Agriculture (RCA) (1928) aptly remarked that "in no sphere has scientific

research conferred greater benefits on agriculture than by the provision of means of controlling livestock diseases"¹. It may also be pertinent to mention a recent statement of the Chief, Animal Production and Health, Food and Agriculture Organization of the United Nations (FAO) that all the extra food required to meet the current world shortfall could certainly be provided if the annual losses due to animal diseases and parasitism are effectively controlled.²

35.1.3 The production of the indigenous livestock is very low as compared to that of the animals in countries with better breeds of livestock. A massive programme of crossbreeding with exotic animals was, therefore, initiated during the Fourth Plan. It has, however, been realised by experience that without adequate health cover all attempts to improve the production capacity of livestock are doomed to failure. This applies particularly to the programmes of improving the production of the indigenous stock by crossbreeding with exotic animals, as exotic and crossbred animals are more susceptible to the diseases and pests prevalent in India. Consequently, the necessity for an efficient and well-knit animal health organization has become all the more imperative.

35.1.4 For building an efficient animal health service, the existing facilities for clinical and preventive veterinary medicine and for diagnosis and investigation of diseases will have to be greatly expanded. It will also be necessary to strengthen the veterinary biological production stations and the animal disease research centres. Since several contagious and infectious diseases are still prevalent in the country, an efficient animal disease control and intelligence service will be essentially required. Further, the quarantine organization will have to be considerably strengthened in order to prevent the ingress of exotic diseases. A Veterinary Public Health Service will also have to be set up for safeguarding the health of human population from zoonoses and food borne diseases particularly those communicable through milk, meat, eggs, fish and shell fish. For maintaining the health and productive capacity of the exotic and crossbred animals, as also of the high producing indigenous animals, adequate supplies of feeds and fodder of good nutritive quality will have to be made available, particularly to prevent malnutrition and the deficiency diseases.

35.1.5 In the following Sections the present position of the animal health organizations in the country is discussed and suggestions are offered to build up a sound animal health service vitally required for the success of the livestock development programmes.

1. Royal Commission on Agriculture in India 1928. *Report of the Royal Commission on Agriculture in India*, p. 312. H.M. Stationery Office, London.

2. Kesteven, K.V.L. 1966. *Veterinary Science in Transition*, p. 2, University of Queensland, Australia.

2 CLINICAL AND PREVENTIVE VETERINARY MEDICINE

Veterinary Dispensaries/Hospitals

35.2.1 There were 904 veterinary hospitals and dispensaries in British India at the time of the submission of the Report of the RCA in 1928. In reviewing the strength of the veterinary services the Commission remarked that "no satisfactory progress can be made in combating contagious diseases of livestock, or even in dealing with other ailments of cattle, unless the staff of the veterinary departments in all Provinces is very greatly expanded" and that "the aim should be to provide on an average at least one veterinary assistant surgeon for every 25,000 cattle".¹ In making this recommendation the Commission was conscious of the fact that if western standards were to be taken into consideration this number of veterinarians would be quite inadequate, as will be evident from the Commission's observations reproduced below :

"To those accustomed to the standards of western countries, our suggestions for the protection from epidemic diseases and for veterinary treatment of Indian livestock may well appear to be quite inadequate, but they represent a very large increase on the provision now made for veterinary aid and, by the time the increase in staff we have suggested is reached, we have little doubt that another enquiry into the position of agriculture in India will have become due. Our successors will then be able, in the light of experience gained in the interval, to determine what further provision for the control of disease may be called for".¹

35.2.2 Despite the progressive increase in the number of veterinary hospitals and dispensaries in our country during the successive plans, even the level recommended in 1928 by the Royal Commission is yet to be attained. The total number of veterinary hospitals/dispensaries was 2,656 at the end of the First Plan and 5,923 at the end of the Third Plan. By the close of the Fourth Plan there were 9,495 veterinary hospitals/dispensaries², i.e., roughly one for 26,000 'cattle units'. In making these calculations the following factors of livestock units have been applied :³

Cattle, Buffaloes, equines	1.0
Sheep and Goats	0.1
Pigs	0.2
Poultry	0.01

¹ Royal Commission on Agriculture in India 1928. *Report of the Royal Commission on Agriculture in India*, p. 298, H.M. Stationery Office, London.

² Planning Commission, Government of India, 1974. *Draft Fifth Five Year Plan, 1974-79: Part II*. Planning Commission, Government of India, New Delhi.

³ Report of the Second Meeting of the FAO/WHO Expert Panel on Veterinary Education, 1963. Rome.

35.2.3 In recent years, the quality of our animals has improved considerably from the position in 1928 when the Report of the RCA was submitted. Moreover, with the spectacular advancement of knowledge in the field of preventive medicine it has now become possible to organise national campaigns for systematic control and eradication of a number of the more harmful animal diseases. Several such programmes have been proposed in Section 5 of this Chapter. These programmes, conceived on massive scale, are of vital importance for the development of livestock and will have to be taken up on priority basis. Otherwise the ravages of infectious diseases will not allow the animal industry to develop. For taking up these programmes and for providing an efficient animal health cover, the number of veterinarians will have to be considerably increased. The Kaira District Cooperative Milk Producers' Union is employing even for buffaloes one veterinarian for about every 10,000 animals. In the developed countries, a ratio of one veterinarian to 3,000—5,000 livestock units is in operation since sixties. As massive programmes of livestock development through crossbreeding have already been taken up in India and the high producing animals are more susceptible to diseases, it has become imperative to narrow down the ratio of the veterinarians to the livestock population. In our opinion, there should be at least one veterinarian for every (a) 20,000 cattle units by 1980, (b) 10,000 cattle units by 1990 and (c) 5,000 cattle units by 2000 AD. In areas of intensive livestock production, it would be necessary to have one veterinarian for every 10,000 cattle units from the Fifth Plan period itself so that an effective health cover may be available to sustain the improvement effected in the genetic make up and productive capacity of the animals. Veterinary services in such areas may be provided through the cooperatives as has been done by the Kaira District Cooperative Milk Producers' Union in Gujarat State.

35.2.4 Improvement of the existing facilities for treatment of livestock diseases requires urgent attention. At present most of the veterinary hospitals are poorly equipped, do not have modern aids for arriving at prompt and correct diagnosis of diseases, and lack facilities for undertaking surgical operations, particularly in the field of obstetrics and gynaecology. Even drugs for treatment of common ailments are in short supply. It is necessary that all veterinary hospitals/dispensaries should have sufficient stocks of medicines as well as facilities for routine laboratory examinations and undertaking surgical operations. A mobile veterinary clinic should be provided at every veterinary hospital so that veterinary aid can be carried right to the door of the livestock owner, whenever necessary. All veterinary

hospitals should have microscopes, and refrigerators for storing antibiotics, biological products, reagents and materials for laboratory examination. At the district level, polyclinics should be established in order to introduce multi-disciplinary approach in combating animal diseases, reproductive disorders, and nutritional imbalances. These polyclinics should have well-equipped operation theatres, refrigeration facilities, an epidemiological unit, and diagnostic laboratories having facilities for undertaking cultural as well as serological examinations in addition to routine diagnostic tests. For rendering highly specialised service on all matters pertaining to clinical and preventive veterinary medicine, a first-rate polyclinic should be built up at the State level.

34.2.5 There were 9,495 veterinary hospitals and dispensaries in the country at the close of the Fourth Plan period. All these are financed from public funds and provide treatment practically free of charge. The cost of prophylactic vaccinations, except that against foot-and-mouth disease, is also met by the State. This concept of free veterinary aid perhaps originated from the fact that the farming community in general was not in a position to pay for the treatment, the quality of the animals was poor and the epidemics of animal diseases were widespread. However, with the gradual improvement in the livestock particularly as a result of crossbreeding through the use of superior exotic germplasm, and the general uplift in the economic condition of the farmers due to modernisation of agriculture, the whole perspective is undergoing a gradual change. Many livestock owners are now keenly interested in having an effective health cover for their animals, even on payment. There is thus an urgent need to considerably improve the quality of veterinary service in the country. For achieving this it will be necessary to supplement the funds of the Veterinary Departments which at present are derived almost wholly from the public exchequer. We strongly recommend that the State Veterinary Departments should introduce immediately a phased programme of levying a charge for the treatment of livestock including prophylactic vaccinations. Some State Governments like those of Himachal Pradesh and Uttar Pradesh, have already started recovering nominal charges in the form of *Parchi* fee. We recommend that other States and Union Territories should also introduce some such schemes immediately. The charges should cover about 25 per cent of the cost of medicines and of special services like surgical operations by 1980, 50 by 1985, 75 by 1990 and 100 per cent by 2000 AD. In areas covered by the intensive livestock development programmes veterinary service at below cost rate may be stopped from the beginning of 1980 so that more funds may be

available to provide a better health cover to ensure greater efficiency in livestock production. However, in case of weaker sections of the community free veterinary service at the hospitals may continue for a few years more.

35.2.6 In some hospitals there is a great demand for the services of veterinarians to attend to cases at the premises of livestock owners. With the improvement of the quality of livestock such demands will increase in these as well as in other hospitals. We recommend that two veterinary doctors should be posted in such hospitals so that when one goes for out-door duty, the other may be available for attending to the cases in the hospital. A system of charging fee for such visits should be introduced immediately. Half of the amount of the fees realised should go to the veterinarian to provide incentive to him and the remaining half should be credited to the Government revenue.

35.2.7 Prophylactic vaccinations should be charged on a no-profit and no-loss basis from the beginning of 1985. However, the services rendered and the biologicals used under the national programmes of disease control and eradication should continue to be free till the objectives of these programmes are achieved. In the event of natural calamities such as floods, drought, large scale outbreaks of infectious diseases, vaccination work to control epidemics should also be carried out free of charge by the States.

35.2.8 At present, the State Governments bear total responsibility for providing treatment of sick animals and for carrying out prophylactic vaccinations. Thus, the funds of Veterinary Departments, which should primarily be used for developing good diagnostic and disease investigation laboratories, for strengthening biological products units, and for building up organisations for undertaking regulatory functions, are in fact being utilized in opening more and more veterinary hospitals and dispensaries, many of which are not properly equipped due to paucity of funds. We envisage that with the gradual development of a flourishing animal industry more and more veterinarians will go in for private practice. The Government should encourage this by providing suitable incentives which may be given in a number of ways. Accommodation at concessional rates for opening veterinary clinics/hospitals at suitable locations could be provided to intending practitioners. Bank credit on easy terms will go a long way in starting private practice. Drugs, surgical instruments and clinical laboratory equipment could be supplied at controlled rates from Government stores and other registered agencies. The veterinary practitioners could be given priority in matters of getting electric, water and telephone connections, and vehicles for professional work.

Disease Investigation and Diagnostic Laboratory Service

35.2.9 Adequate support of well organized disease investigation units and diagnostic laboratories is a basic requirement for improving the clinical and preventive veterinary medical service. At present practically all the States have disease investigation and diagnostic laboratories at the State level and a number of them have separate officers to deal with diseases of different animals, e.g., for cattle, sheep and goats, poultry etc. However, it has been observed that despite the employment of this staff the activities of most of these disease investigation centres are confined to routine diagnosis through examination of material forwarded by field veterinarians. This is mainly due to (a) lack of diagnostic facilities at the peripheral level, necessitating the despatch of all routine specimens to the State Disease Investigation Centre, and (b) inadequacy of laboratory facilities, especially for conducting bacteriological, virological and histopathological examinations at the State Disease Investigation Centre. Consequently, these centres are not in a position to take up proper disease investigation and surveillance work.

35.2.10 It is the responsibility of the State disease investigation centre to arrive at quick diagnosis of diseases. The centre has also to undertake investigation of obscure diseases and to develop methods for their control. In view of these important responsibilities, the State disease investigation centre should have specialists in diseases of different species of animals as well as in different disciplines directly related to the field of animal diseases, and should be headed by a well qualified and experienced expert on animal diseases. The centre should be equipped with adequate laboratory facilities, including those for tissue culture and should be provided with mobile laboratories for quick movement of the staff and equipment to the field for collection of material and for rendering expert technical aid.

35.2.11 Since the disease investigation centres are primarily meant to advise and assist field veterinarians in controlling animal diseases, these should be under the administrative control of the State Directors of Veterinary Services* and not of the agricultural universities as is the case in one State at present. These centres should, however, actively collaborate and draw on the expert advice and laboratory facilities of the constituent veterinary colleges of the agricultural universities. To enable the agricultural universities to undertake these responsibilities and discharge these efficiently and effectively, it would be necessary to suitably strengthen the departments concerned with

* The functionaries are designated variously in the different States as Director of Veterinary Services, Director of Animal Husbandry, Director of Veterinary Services and Animal Husbandry.

disease diagnosis and investigation work in the universities.

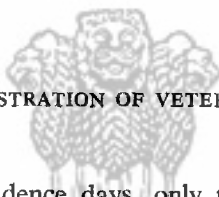
35.2.12 At the national level, the IVRI, as the Central Research Institute of the country, provides the necessary assistance to the States for tackling disease problems which cannot be investigated at the State level. This makes it more or less obligatory for the disease investigation unit at the IVRI to have experts of a very high calibre capable of rendering specialised service in their respective fields. The IVRI should also serve as a reference laboratory for identification of casual agents isolated at the State disease investigation centres and the veterinary colleges which require confirmation. It should also undertake the supply of standard antigens, antisera and diagnostic agents for standardisation of biologicals produced at the State biological production centres and should serve as a repository of important cultures of microorganisms.

35.2.13 As for diagnostic laboratories, we have earlier suggested that there should be a well-equipped unit at each district veterinary hospital where in addition to routine diagnostic tests facilities for undertaking cultural as well as serological examinations should be made available. We have further proposed that facilities for carrying out routine laboratory examination for diagnostic purposes should be provided at each veterinary hospital/dispensary. Once such a network of laboratories is established, it should be possible to improve considerably the existing clinical and preventive veterinary medical services and to provide the required laboratory support to the animal disease control/eradication programmes recommended in Section 5 of this Chapter.

Special Organisation for Exotic Diseases

35.2.14 Imports of livestock and livestock products are on the increase. With this, the chances of introduction of exotic infections have increased considerably and, despite strict quarantine measures, it would not be possible altogether to stop the ingress of diseases and parasites from other countries. It has, therefore, become necessary to establish an organization, consisting of veterinarians specialised in exotic diseases. This organization can be pressed into service as soon as an exotic disease is suspected to have gained entry into the country. For building such an organization, we suggest that a couple of senior veterinarians well versed in livestock diseases from each State/Union Territory should be deputed abroad for a period of two to three months for acquainting themselves with the techniques of diagnosis and control of such exotic diseases as are likely to be brought in with imported livestock/livestock products. After their return these

officers should be posted back to the Veterinary Departments in their respective States/Union Territories. However, in the event of an exotic disease being spotted in any part of the country the full complement of these specially trained veterinarians should be mobilised under the guidance of the Joint Commissioner (Livestock Health) in the Division of Animal Husbandry of the Union Ministry of Agriculture and Irrigation. The Joint Commissioner should be responsible for dealing with the situation and for deciding the strategy to control and eradicate the infection by coordinating the activities in this regard in the different States. A few Biological Production Specialists should also be deputed abroad to make them proficient in the manufacture of the diagnostic agents and vaccines needed for combating exotic diseases and to prepare them locally as and when required. The veterinarians trained in exotic diseases and in the manufacture of biological products for their control should be sent abroad periodically for refreshing their knowledge.



3 REGISTRATION OF VETERINARIANS

35.3.1 In pre-Independence days, only the veterinarians qualifying from the Royal Veterinary Colleges in the United Kingdom and registered under the U.K. Veterinary Surgeons' Act of 1881 were legally authorised in India to issue professional certificates such as those for medico-legal cases, import and export of livestock and livestock products, soundness of horses etc. The veterinarians qualifying from the veterinary colleges in India did not have such legal authority as there was no statutorily recognized body either at the Centre or in the States for their registration. This anomalous position was discussed in December, 1951 at the Joint Meeting of the All-India Veterinary Association and the Bombay Veterinary Medical Association under the Chairmanship of the then Union Minister of Food and Agriculture. The Minister appointed a Steering Committee to go into the question of establishing a National Veterinary Council. The Steering Committee made the following recommendations :

"1. State Veterinary Councils should be set up by legislation in the States on the model of the U.P. Veterinary Council Act, 1947.

2. A Statutory National Veterinary Council should be set up in due course by providing representation on this body from the State Councils and by nominations by the Central Government with the following objectives :

(a) To provide a statutory organisation representing the veteri-

nary profession to serve as a liaison body between Government and the veterinary profession, and between the Government of India and the International Veterinary Congress ;

- (b) To control and regulate the practice of the profession and the conduct of its members and to uphold the status and dignity of the profession ;
- (c) To arrange for reciprocity of recognition of the various veterinary qualifications in inter-State and international circles and also in the Indian Army ;
- (d) To maintain a recognised Register of Veterinary Practitioners in the country to remove handicaps to the profession, such as (i) non-recognition of the graduates of Indian Veterinary Colleges by Turf Clubs, Livestock Insurance Companies, Chemists, Druggists, etc. (ii) non-recognition of these graduates to give evidence as an expert under Section 45 of the Indian Evidence Act on any matter relating to Veterinary Science.
- (e) To remove the difficulty experienced at present by the public to distinguish between a qualified and an unqualified veterinary practitioner”.

35.3.2 The Steering Committee further recommended that, as it would take some time for the States to pass legislation on the lines mentioned above, an Interim Indian Veterinary Council should be set up without legislative backing consisting of members nominated by the States and the Union Government with the following functions and objectives :

- “(i) To serve as a liaison body between Government and the veterinary profession;
- (ii) To help in the formation of State Veterinary Councils in all the States in the Indian Union till such time as the statutory councils had been formed; and
- (iii) To advise the Central and State Government on all matters concerning the veterinary profession”.

35.3.3 The above recommendations of the Steering Committee were accepted by the Government of India, and an Interim Indian Veterinary Council was set up for a period of five years or till such time as a Statutory Veterinary Council was established¹. The Interim Indian Veterinary Council completed its first term of five years on the 28th of October, 1959, but as the Statutory National Veterinary Council had not come into being till then, the term of the Interim

¹ *Ministry of Food and Agriculture (ICAR)*, Government of India. Resolution No. F.26(1)/54/AH of 29 October 1954. *Ministry of Food and Agriculture (ICAR)*, Government of India, New Delhi.

Indian Veterinary Council was extended for a further period of three years¹.

35.3.4 To facilitate expeditious constitution of State Veterinary Councils and to secure uniformity in rules, regulations and procedures of these bodies, a draft model Act and a set of model rules and regulations for the establishment of Statutory Veterinary Councils in the States were prepared by the Interim Indian Veterinary Council in November, 1958. These were circulated by the Government of India (ICAR) to all the State Governments in January, 1959 with a request to expedite formation of Statutory Veterinary Councils in the States. The matter regarding the establishment of State Veterinary Councils was also discussed in the Conference of the State Ministers of Agriculture in 1960. The Conference recommended that the State Governments should expedite the establishment of State Veterinary Councils. The urgent need for forming Indian Veterinary Council has also been repeatedly stressed by the Indian Veterinary Association. In the professions of human medicine and dentistry, such Statutory Councils were formed in 1938 and 1948 respectively. These are functioning very effectively and acting as a good liaison between these professions and the Government.

35.3.5 We strongly recommend that an Indian Veterinary Council, on the lines of the Indian Medical Council, should be formed immediately. We have consulted the States and they are unanimously in favour of this proposal as without registration of the veterinarians with such a statutory body (a) the prescriptions given by them for potent and poisonous drugs may not be served by the Chemists and Druggists under the Drugs Control Act; (b) their certificates for the purpose of export of animals and animal products or for inter-State movement of animals or for the purpose of livestock insurance will not be legally acceptable ; and (c) they will not have the legal authority to give evidence as an expert under Section 45 of the Indian Evidence Act on any matter relating to veterinary science.

35.3.6 The main objects of the Indian Veterinary Council should be (a) to act as a liaison body between the veterinary profession in India and the Government; (b) to maintain a statutorily recognised Register of veterinary practitioners in the country; (c) to draw up a code of ethics to regulate and control the conduct of its members ; (d) to promote and advance the development of veterinary science ; and (e) to effect liaison between the veterinary profession in India and the international veterinary organisations.

35.3.7 Since veterinary is a State subject, the concurrence of the

¹ Ministry of Food and Agriculture (ICAR), Government of India. Resolution No. 26(5)/59-AH. II of 23 November 1959. Ministry of Food and Agriculture (ICAR), Government of India, New Delhi.

State Governments will be necessary before the Government of India can enact the legislation for setting up an Indian Veterinary Council. This aspect was carefully examined by the Steering Committee appointed in December, 1957 by the Ministry of Food and Agriculture. The Steering Committee recommended that State Veterinary Councils should be set up by legislation in all the States and that a statutory Indian Veterinary Council should then be brought into being by providing representation on the Central body from the State Councils, and by nominations by the Central Government. However, the Veterinary Councils have actually been formed and are functioning at present only in two States, viz., West Bengal and Maharashtra. We recommend that the State Governments should give high priority to the formation of State Veterinary Councils and that the Department of Agriculture, Union Ministry of Agriculture and Irrigation, should constitute an Indian Veterinary Council immediately.

4 VETERINARY BIOLOGICAL PRODUCTS

35.4.1 Production of veterinary biologicals in India was initiated in 1898 at the IVRI. In 1924, a well organized production centre was established at the Izatnagar station of the IVRI. As the demand for biological products grew it was realised that it would not be possible for one biological production centre located at the IVRI to meet the country's needs. Moreover, the fragile nature of the biologicals posed serious difficulties in their transportation over long distances. It was, therefore, decided that the States should be encouraged to start their own centres and become as far as possible self-sufficient in meeting their needs of the commonly required vaccines, sera, and diagnostic agents. Thus, 15 State biological production centres came into existence between 1926 and 1972. These are located one each in the States of Mysore, now Karnataka (1926), Madras, now Tamil Nadu (1932), United Provinces, now Uttar Pradesh (1945), Orissa (1946), Andhra Pradesh (1947), Bombay, now Maharashtra (1947), Punjab, now Haryana (1950), Bihar (1954), Rajasthan (1954), Assam (1956), Kerala (1959), Jammu & Kashmir (1963), Madhya Pradesh (1964), West Bengal (1965) and Punjab (1972). One production centre is also being set up in the State of Gujarat. Even with the existence of so many production centres, the availability of different vaccines and diagnostic agents, is far below the requirements. As such, urgent steps will have to be taken to increase their production to meet the rapidly growing demands.

35.4.2 At present most of the State production centres prepare only a limited number of biologicals and the State Veterinary Departments depend on the IVRI for meeting their requirements of the others. This arrangement does not seem to be working satisfactorily, as the IVRI, the main function of which, after reorganisation of the ICAR, is to carry out research in the field of animal science, cannot cope with the demand of all types of biologicals required throughout the country. Several infectious diseases are endemic and widely prevalent, and the demand for vaccines and other biological products is enormous. Thus, there are frequent breakdowns in the supplies to the States, thereby causing serious setback to animal health coverage programmes. With the systematic implementation of the animal disease control programmes recommended by us the demand for biologicals will increase manifold. The State production centres should, therefore, be suitably strengthened and expanded on a priority basis. Within a period of about two years they should be in a position to meet the full requirements of at least the simple types of biologicals for controlling diseases like haemorrhagic septicaemia, black-quarter, anthrax, brucellosis, swine fever, enterotoxaemia, sheep pox, Ranikhet disease, and fowl pox. As regards the more sophisticated products like the foot-and-mouth disease vaccine, rinderpest tissue culture vaccine, anti-rabic vaccine, Marek's disease vaccine, mycoplasma antigen, tuberculin, johnin etc., we suggest that the State production centres which have fairly good laboratory facilities like those at Mhow, Ranipet, Poona, Lucknow, Hyderabad and Hissar, should be encouraged to take up their production. These centres should meet the demands of the whole country in respect of these sophisticated biologicals till the remaining State Centres are also able to start their manufacture. This will gradually relieve IVRI from the responsibility of manufacture of biologicals, except some selected ones, so that the Institute may concentrate on the development of technical know-how and methodology for the production of newer biologicals for the control of emerging diseases and for improving the quality of the existing vaccines and diagnostic agents.

35.4.3 Some of the State biological production centres were established many years ago. But they have not yet come up to the desired standards. It has been brought to our notice that shortage of funds and procedural delays in the working of the government departments, are standing in the way of their proper functioning and expansion. Further, the posts of the Officer-in-charge of a number of production centres carry poor scales of pay, not commensurate with their status

and responsibilities. Therefore, they do not attract the right type of talent. It is our considered opinion that for improving the efficiency of the production centres, these should be allowed to function with some freedom from the usual restrictions of government rules and regulations and should be run on commercial lines. These facilities for implementation could be achieved if the production centres are converted into public sector undertakings. We, therefore, recommend that the State biological production centres should be converted into State Biological Products Corporations, and the Division of Biological Products of the IVRI along with the Foot-and-Mouth Disease Vaccine Production Centre at Bangalore into National Biological Products Corporation.

35.4.4 There is no need to set up independent biological production centres in the smaller States/Union Territories of Manipur, Arunachal Pradesh, Tripura, Meghalaya, Nagaland and Mizoram. Their demand can be more economically met from a Regional Biological Products Station. The management of such a Station could be vested in a joint body consisting of representatives of all the State Departments of Veterinary Services in the area who could lay down the policies and programmes to be implemented. In our opinion the Biological Production Centre, Gauhati after suitable expansion can be developed into a Regional Biological Products Station. As regards the other States and Union Territories not having their own biological production centres, they may obtain their requirements from the neighbouring States having such facilities.

35.4.5 In order to plan systematically the expansion of the production programmes proposed above, we recommend that an Expert Committee on Biological Products may be constituted by the Government of India to assess the special requirements of the State biological production centres in respect of laboratories, equipment and training of personnel both in India and abroad. The Planning Commission has tentatively earmarked a sum of Rs. 10 crores, 5 crores in the Central sector and an equal amount in the State sector, for the strengthening and expansion of the State production centres during the Fifth Plan. For implementing our recommendation this amount is considered inadequate. The Expert Committee on Biological Products should look into it and recommend further financial allocation during subsequent plan periods for this very important programme.

35.4.6 The Government of India had set up in 1952, a Committee on Standardisation of Veterinary Biological Products, which prepared schedule F₁ giving the specifications for the standardisation of biological products. Since then the production of several new biologicals has been taken up, and the revision of schedule F₁ has become

necessary. We recommend that another Expert Committee on Standardisation of Biologicals should be constituted to revise this schedule and bring it up-to-date.

35.4.7 In July, 1969 the manufacture of veterinary biological products was brought under the purview of the Drugs and Cosmetics Act, 1940. It has, therefore, become necessary to develop a suitable organization for effective enforcement of the provisions of the Act. At present the Drugs Controller (India), Directorate General of Health Services (DGHS), Ministry of Health and Family Planning, Government of India and the State Drugs Controllers are also looking after the veterinary biologicals. In our opinion, it is desirable to create a post of Controller, Veterinary Biological Products and Drugs, with supporting staff in each State to enforce the provisions of this Act in respect of veterinary biological products and veterinary drugs so as to have an effective check on their quality. At the Centre, a post of Chief Controller, Veterinary Biological Products and Drugs with supporting staff should be created in the Department of Agriculture, Union Ministry of Agriculture and Irrigation, and a Veterinary Biological Products and Drugs Advisory Board should be set up to advise the Government on all matters concerning the veterinary biological products and veterinary drugs.

35.4.8 At present, the Division of Standardization of Biological Products of the IVRI is the only recognized laboratory for testing samples of biologicals for their quality under the Drugs and Cosmetics Act. We are of the opinion that it is difficult for this Division to cope with quality control work of this magnitude in view of its multifarious responsibilities. Also, as there is no civil airport nearby samples of fragile biologicals quite often do not reach the Division from the State Drug Controllers in a satisfactory state. Therefore, we recommend that a National Veterinary Biological Products Quality Control Institute under the administrative control of the Department of Agriculture, Union Ministry of Agriculture and Irrigation, should be set up near some airport. A full-fledged Institute alone can exercise proper vigilance over the quality of enormous quantities of biological products needed in a vast country like India.

5 CONTROL OF ANIMAL DISEASES

35.5.1 The Royal Commission on Agriculture emphasized that the general prevalence of contagious diseases in India was probably one of the most serious obstacles in the way of improvement of cattle.

During the last few decades substantial progress has been made in developing a large number of highly efficacious methods and biologicals for protecting livestock against diseases. Still the occurrence of several diseases in epidemic form hampers sustained development of livestock production. Along with the increasing tempo of development of higher productivity of livestock, efforts on control and eradication of their diseases will have to be adequately strengthened and reinforced. In the following paragraphs some of the important programmes for control and eradication of animal diseases are discussed.

Rinderpest

35.5.2 An organised national programme for mass vaccination of cattle and buffaloes against rinderpest with the ultimate objective of its eradication from the country was started on October 1, 1954 in the form of a Pilot Project to cover parts of the present States of Andhra Pradesh, Karnataka and Maharashtra. Under the Pilot Project about 16 million cattle and buffaloes were vaccinated, the vaccination coverage being around 90 per cent. In view of the very encouraging response from the livestock owners and the valuable experience gained in the execution of the Pilot Project, the rinderpest eradication programme was extended over the whole country during the Second and the Third Five Year Plans. The programme envisaged that no less than 80 per cent of cattle and buffaloes should be vaccinated within a short period of say, 5 years, and then follow-up vaccination undertaken to cover the young stock born during the interim period till the country was free from the disease.

35.5.3 During the Second Five Year Plan, mass vaccination programme was introduced in all the States including the Union Territories and check-posts were set up on some important cattle movement routes. Programmes for creation of immune zones at international borders adjoining the States of Uttar Pradesh, Bihar, West Bengal, Punjab, Rajasthan and Gujarat were also started and vaccination stations were established at the international borders to immunize the animals crossing the borders. During subsequent plan periods, the programme was vigorously followed. As a result of this large scale vaccination campaign, the incidence of the disease got drastically reduced. In 1965, only 306 outbreaks occurred resulting in the loss of 2,214 animals¹ as against an average of 8,000 annual outbreaks killing about 200 thousand animals before the launching of this programme. In the next year there was, however, a sudden increase in the incidence

¹ Ministry of Food and Agriculture (ICAR), Government of India, 1966, 1968. *Animal Health Information Service : Contagious Diseases Bulletins for the years 1966 and 1968*. Ministry of Agriculture (ICAR), Government of India, New Delhi.

of rinderpest and there were 577 outbreaks causing a mortality of 3,598 cattle and buffaloes¹. This was due to re-entry of the disease into the States of Tamil Nadu, Kerala and Karnataka which had been free from it for over two decades and had been excluded from the mass vaccination programme. The source of infection was traced to entry of animals from infected areas of the northern region of the country. Immediately following the outbreaks of the disease, mass vaccination programme was taken up in these three States. The upward trend in the incidence of rinderpest was checked by 1968 when the number of outbreaks in the country dropped to 403 with a total mortality of 2,685 cattle and buffaloes². In 1974, only 231 outbreaks, causing death of 1,559 animals occurred².

35.5.4 From the start of the National Rinderpest Eradication Programme in October, 1954 and up to March 31, 1973, as many as 449.65 million vaccinations against rinderpest had been carried out³. The Government of India had spent about Rs. 9.37 crores on this programme till March 31, 1974, and the States had been spending about Rs. 70 lakhs every year to keep the disease under control. Although the amount spent so far under the vaccination programme has paid rich dividends and the success achieved in reducing the losses substantial, the stage has now come when the strategy needs to be changed. No country can afford continuation of a vaccination programme of this magnitude year after year.

35.5.5 Future Approach : A stage has now come when a final thrust should be made to wipe out the disease from the few areas in which it is still persisting. For achieving this objective, the following strategy is recommended :

- (i) Necessary material from each and every suspected outbreak of rinderpest should be expeditiously subjected to laboratory examination, and the State diagnostic laboratories should be suitably strengthened for prompt examination of the material for diagnosis of rinderpest and allied diseases.
- (ii) The source of each and every outbreak should be scrupulously traced and definite remedial measures taken to ensure that the lapses responsible for the outbreak do not recur. Detailed report on each outbreak should be prepared by the Central Rinderpest Unit in the Animal Husbandry Division

1 Ministry of Food and Agriculture (ICAR), Government of India. 1966, 1968. *Animal Health Information Service : Contagious Diseases Bulletins for the years 1966 and 1968*. Ministry of Agriculture (ICAR), Government of India, New Delhi.

2 Ministry of Food and Agriculture (ICAR), Government of India. 1966, 1968. *Animal Health Information Service : Contagious Diseases Bulletins for the years 1969 and 1974*. Ministry of Agriculture (ICAR), Government of India, New Delhi.

3 Ministry of Agriculture, Government of India. *Rinderpest News Bulletins for the year 1973*. Ministry of Agriculture, Government of India, New Delhi.

of the Ministry of Agriculture and Irrigation and circulated to all the States promptly. In the case of an outbreak near the borders of a State, the neighbouring State authorities should be immediately alerted.

- (iii) The number of checkposts on common cattle routes at the international and interstate borders and the number of vigilance units at interstate borders should be increased. It has been calculated that about 150 checkposts and 120 vigilance units will be required. While deciding the location of the checkposts it should be ensured that all cattle routes leading to the forests are also fully covered.
- (iv) Wild animals may act as reservoirs or carriers of rinderpest virus. As such, all cattle and buffaloes going into the forests for grazing should be vaccinated at the forest checkposts.
- (v) The Veterinary Departments should intensify the follow-up vaccination programme.
- (vi) Stamping-out policy i.e., the destruction of affected animals on payment of compensation and ring vaccination with rinderpest tissue culture vaccine around scenes of outbreaks of the disease, should be gradually introduced.

35.5.6 It is expected that by carrying out intensive vaccination programmes at checkposts and interstate borders the incidence of the disease will be reduced considerably by the end of the Fifth Plan. That would be the ideal time to take up the stamping-out policy. Continuation of the mass vaccination programme beyond that stage will be technically unnecessary and may even be economically wasteful.

35.5.7 Mass propaganda should be carried out to educate the livestock owners about the rationale of the stamping-out policy. This will prepare the necessary ground for enlisting whole-hearted voluntary participation of livestock owners in the programme. All efforts should be made to bring the whole country under the stamping-out policy within the shortest possible time. The Government of India may pay the compensation for the animals destroyed under this programme till 1985 in order to give incentive to the States to take up this work vigorously. It is expected that by 1985 rinderpest would be completely brought under control. At that stage compensation should be paid by the States if it becomes necessary to destroy any animal under this programme and the Centre should be responsible only for regulatory functions.

35.5.8 When the National Rinderpest Eradication Programme was formulated it was envisaged that it might be necessary also to

vaccinate sheep and goats against rinderpest in order to eradicate the disease. However, in the light of the experience gained in the working of the Rinderpest Eradication Programme during the last two decades, campaign for vaccination of sheep and goats is no longer considered necessary. A more practical approach in case of sheep and goats and also pigs would be to follow the stamping-out policy as recommended for cattle and buffaloes.

35.5.9 Freeze-dried rinderpest goat tissue virus (GTV) has till recently been the vaccine mostly used in the Rinderpest Eradication Programme. For highly susceptible stock such as exotic, crossbred and hill cattle, and also for other high-yielding cows and buffaloes and for those in advanced stage of pregnancy, the lapinised vaccine was used up till the Third Plan period. With the availability of tissue culture vaccine, the necessity of manufacturing different types of rinderpest vaccines, one for less susceptible stock and another for highly susceptible stock, has been obviated. The experience gained with the tissue culture vaccine in India and abroad has made it a product of choice, as it is more economical to produce, does not induce any untoward reaction even in highly susceptible stock, and produces a durable immunity. The Central Rinderpest Control Committee (CRCC) in its 26th meeting held in September 1973 recommended that the country should now switch over to tissue culture vaccine since it is safe for all types of cattle, buffaloes, sheep and goats. We endorse this recommendation of the CRCC.

35.5.10 At present the tissue culture vaccine is being produced at only two centres, viz., the Division of Biological Products, IVRI, Izatnagar, and the Institute of Veterinary Preventive Medicine, Rani-pet. Since the demand for this vaccine will increase manifold during the coming years, we recommend that the State Biological Production Centres located at Mhow, Lucknow, Hyderabad, Bangalore, Calcutta and Hissar should also take up its manufacture on a priority basis. In order to ensure supply of fully potent vaccine, the biological production centres should adopt the norms laid down by the WHO Expert Committee on Biological Standardisation¹.

35.5.11 Research : Now that the final thrust to wipe out the residual foci of rinderpest infection is to be made, it is essential to intensify research work on problems which are likely to influence the success of the ultimate phase of the eradication programme. With this end in view, systematic epidemiological studies with particular reference to the role of carriers or reservoirs in the dissemination of the disease should be undertaken. In this connection, it is necessary to intensify studies on rinderpest in sheep, goats and pigs. Moreover,

¹ WHO. 1970. Technical Rep. World Health Organisation.

further work should be carried out to determine the duration of immunity conferred by the rinderpest tissue culture vaccine in indigenous, crossbred and exotic cattle as well as in buffaloes, sheep, goats and pigs.

Foot-and-Mouth Disease

35.5.12 Foot-and-mouth disease (FMD) is highly endemic in India and widespread outbreaks occur throughout the country all the year round. An analysis of the reported outbreaks of the disease among cattle and buffaloes during the period 1962—1973 has shown that on an average about 5,000 outbreaks involving as many as 2,75,000 animals occur each year¹. The annual loss due to this scourge has been estimated to be as high as Rs. 4 crores².

35.5.13 Foot-and-mouth disease has become all the more important as extensive production oriented crossbreeding programmes have recently been undertaken. The exotic and crossbred animals are much more susceptible to this disease than the local cattle. In the indigenous stock the morbidity due to FMD is high but mortality is low, while in exotic and crossbred animals both morbidity and mortality are high. Little success can be expected in the improvement of the livestock industry unless this disease is effectively brought under control. We, therefore, recommend that a national programme for its systematic control should be taken up immediately.

35.5.14 Control : In India FMD is highly endemic and widespread outbreaks occur throughout the year. Its control cannot be economically achieved by slaughter or stamping-out policy as followed with benefit in some of the western countries, until its incidence is drastically reduced. The only practical approach to its systematic control is : (a) to carry out scientifically planned prophylactic vaccination campaigns on an extensive scale; (b) to check the spread of infection by undertaking ring vaccination around the scenes of outbreaks and by enforcing strict hygienic measures; and (c) to carry out symptomatic treatment of affected cases to prevent complications from secondary bacterial infections. However, non-availability of the FMD vaccine in sufficient quantities and its high cost are the main hurdles in the implementation of the vaccination programme. Production of the vaccine should, therefore, be stepped up immediately and efforts made to reduce its cost of production.

¹ Ministry of Food and Agriculture (ICAR), Government of India. 1966, 1968. *Animal Health Information Service : Contagious Diseases Bulletins for the years 1962—66, and for the years 1967—73*. Ministry of Agriculture (ICAR) Government of India, New Delhi.

² Dhanda, M. R. and Gopalkrishna, V. R. 1958. Res. Ser. 16, p. 3-4, Indian Council of Agricultural Research, New Delhi.

35.5.15 Vaccine production : At present, FMD vaccine is being produced at the IVRI and by a private pharmaceutical concern. The total production of the two concerns is at present only half a million doses a year, against an estimated annual requirement of about 10 million doses. In order to meet a part of this requirement a Regional Station of the IVRI was set up at Bangalore in 1972 with Danish assistance to produce one million doses of the vaccine annually. Besides, Bharatiya Agro-Industries Corporation Urli Kanchan is establishing a vaccine production centre in the State of Maharashtra, and the Indian Dairy Corporation is also contemplating to take up large scale manufacture of this vaccine. Even after all these centres come into production, there will still be a wide gap between the actual requirements and the production. As such, it is necessary that State biological production units should also take up the manufacture of this vaccine, as recommended in Section 4 of this Chapter.

35.5.16 Types : Out of the seven major immunological types of foot-and-mouth disease virus, only four, viz., O, A, C and Asia I, have so far been recorded in India. It is, therefore, extremely important that quarantine measures are rigorously enforced to ensure that SAT I, SAT II and SAT III or any other new strain do not gain entry into the country, otherwise the problem of control of FMD will become all the more complicated and difficult.

35.5.17 Recent researches have shown that antigenic variation in the FMD virus group is becoming more and more complex. At least 60 distinct sub-types within the group have already been identified. Some observations under experimental conditions also point to the possibility of changes in sub-types. As such, it is important that the virus typing service should be suitably strengthened so that the epidemiology of the disease under Indian conditions is better understood. This will help in selection of the most commonly occurring antigenic types for the manufacture of more efficacious vaccines against FMD. At present, an All-India Coordinated Research Project is functioning with a Central Laboratory at the IVRI and seven regional centres in different States. The main objective of the project is to carry out systematic epidemiological studies on the disease and to determine the geographical distribution and seasonal occurrence of the different types and sub-types of the FMD virus prevalent in the country. Eleven FMD epidemiological units are proposed to be set up during the Fifth Plan. This will provide a network of laboratories practically one in every large State for carrying out epidemiological studies on the disease. In our opinion, it is necessary to further strengthen the FMD typing service by opening more centres particularly to cater to the needs of areas of intensive livestock development. This will enable field

veterinarians to use a monovalent vaccine, instead of a polyvalent one, for controlling outbreaks of the disease, thus ensuring more specific immunity and considerably cutting down the cost of vaccination.

35.5.18 Until recently, FMD in pigs received little attention, as there were hardly any organised pig breeding farms. However, with the launching of the Piggery Development Programmes, the disease in pigs has assumed great importance. Limited observations made under Indian conditions have revealed that the exotic breeds of pigs when afflicted with the disease suffer very severely. Unfortunately, no effective vaccine against the disease in pigs is yet available. We, therefore, recommend that the IVRI should intensify research on FMD in pigs and take early steps for the production of an efficacious and inexpensive vaccine. Research work on this disease in sheep and goats with particular reference to the study of its epidemiology should also be intensified, as these species may be playing an important role in the dissemination of the infection over wide areas. As FMD is a very serious disease whose control is to be taken up on a national scale, it would be desirable to constitute a National Advisory Committee on Foot-and-Mouth Disease to supervise the control programme and to offer expert technical guidance in its implementation.

Tuberculosis

35.5.19 Extensive surveys undertaken during the last three decades on tuberculosis among animals have shown that the disease has become a serious threat to the developing dairy industry. The crowding of animals in sheds in certain areas had increased the chances for quick dissemination of the disease. It has, therefore, become necessary that a systematic programme to control the disease among animals with the ultimate objective of its eradication should be immediately taken up at the national level.

35.5.20 Mass tuberculin tests in organised farms and in a few representative areas have revealed that the incidence of tuberculosis among cattle and buffaloes varies widely from herd to herd depending upon the chances of exposure to infection and the hygienic conditions at the farms. In some herds where timely steps to control the infection were not taken, the percentage of cattle showing positive reaction to the tuberculin test was as high as 55. It has been brought to our notice that recently a large number of exotic cattle in some organized herds either died of generalised tuberculosis or had to be destroyed as being tuberculin reactors. We view this with concern not only because valuable exotic stock is being lost due to the disease but also because the disease may become a serious zoonotic problem.

No large scale surveys to determine the incidence of this disease in pigs, sheep, goats and poultry have yet been undertaken in the country. However, from the limited observations made so far it appears that in certain areas tuberculosis is fairly widespread in pigs and ducks but its incidence in sheep, goats and chickens is rather low.

35.5.21 Control : An all-India project for the control of tuberculosis among cattle and buffaloes in organized herds was prepared in 1962 by the ICAR and was approved by the Planning Commission. Very little progress has so far been made in its implementation. Eradication of tuberculosis from animals has now become all the more important as with the starting of intensive livestock production programmes, its incidence is bound to increase considerably unless timely steps are taken to control the spread of infection. In addition, the disease in animals endangers the health of human beings, especially in rural areas where many families and their livestock often share the same premises, and a single tuberculous animal with open lesions may infect the whole family.

35.5.22 'Test-and-Slaughter' policy is followed by most of the western countries in their official programmes for eradication of bovine tuberculosis. This is undoubtedly the best policy for eradication of tuberculosis, but under the existing Indian conditions, 'test-and-segregation' with destruction of open clinical cases and payment of compensation will have the better chances of success, at least in the initial stages of the campaign. Such a programme has been found to succeed in the eradication of the disease from a number of organized farms in our country. However, as the incidence of the disease is brought down by systematic application of control measures, and the livestock owners get better educated about the benefits of the control programme, the advisability of introducing 'test-and-slaughter' policy in selected areas of low incidence of the disease/infection should be examined. In the final stages 'test-and-slaughter' policy will, of course, be the only method for wiping out the last vestiges of the infection.

35.5.23 The 'test-and-segregation' policy will take much longer to control the disease than the 'test-and-slaughter' policy, but in view of the inadvisability of slaughter of a large number of cattle reacting positively to tuberculin but otherwise looking healthy, the adoption of segregation policy with destruction only open clinical cases is preferable.

35.5.24 Control of tuberculosis among animals should be carried out in such a way that as far as possible it should least interfere with the agricultural economy and the normal progress of the animal industry. With this objective in view, we recommend that the

programme may be carried out in a phased manner as outlined below :

- (i) Phase I—Systematic control of tuberculosis on organized farms.

The 'test-and-slaughter' policy would be the most suitable one for making organized farms free from tuberculous infection. However, as already stated, for economic and technical reasons and in consideration of the public sentiments against destruction of tuberculin-reactor cattle and buffaloes, which may otherwise look apparently healthy, 'test-and-segregation' policy with destruction of open clinical cases may be followed in the initial stages of the programme. It should, however, be ensured that no tuberculin reactor is disposed of from the farms under any circumstances excepting for slaughter. In the case of other species of animals such as pigs, goats, poultry in which the extent of infection is low, only 'test-and-slaughter' policy is advocated.

- (ii) Phase II—Extension of the control programme to cover the animals in the entire country.

Work under this phase would involve gradual extension of the area of operation by following the same programme as enunciated under phase I till the whole country is covered.

- (iii) Phase III—Final eradication programme.

At this stage only 'test-and-slaughter' policy should be followed with payment of compensation for the animals destroyed.

35.5.25 In phase I the work should be carried out on a purely voluntary basis and it should be restricted to governmental, institutional and private organized herds. In phase II a certain amount of compulsion for implementing the control programme may have to be introduced. When the programme in the country reaches phase III, the provisions of the Contagious Diseases Act should be enforced to give legal authority for compulsory testing and for destruction of the tuberculin reactors with payment of compensation. We think that phase I can be completed within 10 years from the starting of the programme and that it should be possible to go through phase II within another 15 years' time. Thereafter, efforts should be made to complete phase III within a period of 5 years. However, in the case of areas of concentrated and intensive livestock development, the programme under phase I as well as phase II should start immediately and should be completed within a period of 15 years at the most.

35.5.26 For implementation of the above programme regular supply of properly standardized tuberculin will have to be ensured. Advance action should, therefore, be taken to step up its production as recommended in Section 4 of this Chapter. In order to carry out the control and eradication work most economically, we suggest that

this programme may be taken up simultaneously with the brucellosis control programme. The control organization has, therefore, been outlined under Section 35.5.30 dealing with brucellosis.

Brucellosis

35.5.27 Extensive surveys in the country during the last three decades have revealed that the *Brucella* infection is widespread in organized herds of cattle and buffaloes and that some of these herds have as high as 20 to 30 per cent positive reactors. It is, therefore, important that in the interest of livestock industry and of public health, brucellosis should be systematically controlled and eradicated on a priority basis.

35.5.28 Control : Hitherto only sporadic attempts have been made in the country to control *Brucella* infection in organized cattle and buffalo farms. The policy of 'test-and-segregation' with adoption of hygienic measures is generally followed when the incidence of positive reactors is less than 5 per cent. When it is more than 5 per cent, calfhood vaccination is practised in addition to the 'test-and-segregation' method or 'test-and-disposal' method. In farms having more than 20 per cent reactors accompanied by high rates of abortion, vaccination of adult cows has been undertaken to reduce the rate of abortion. These measures have brought about appreciable reduction in the incidence of the disease in several herds. However, the answer to the serious problem of brucellosis lies in following a more systematic approach and sustained effort to control the disease with its eradication as the ultimate objective.

35.5.29 Earlier, while dealing with tuberculosis, we have suggested that the control programme should be so phased as to least interfere with the agricultural economy and the normal progress of the animal industry. This applies equally well to brucellosis. We, therefore, recommend that the control and eradication programme for brucellosis should be taken up in three phases on similar lines as advocated in the case of tuberculosis. For the success of the programme regular supply of standard antigens for agglutination tests and milk ring test, and of the vaccine will have to be ensured. Advance action should be taken to step up the production of these biologicals as recommended in Section 4.

35.5.30 For implementation of the eradication programme in respect of tuberculosis and brucellosis, an Eradication Officer for these two diseases will have to be appointed in each State. He should be assisted in the tuberculin testing and brucella testing work by a team of veterinarians whose number would depend upon the size of the organized

herds coming within the ambit of the campaign. It would also be necessary to appoint a Chief Tuberculosis and Brucellosis Eradication Officer at the Centre in order to coordinate and guide the programme on a country-wide basis. We further propose that a National Tuberculosis and Brucellosis Eradication Committee on the lines of the Central Rinderpest Control Committee should be set up to chalk out a detailed technical programme, to lay down important guidelines for its implementation and to exercise supervision over the progress of the Tuberculosis and Brucellosis Eradication Campaign.

Mastitis

35.5.31 It is important that all cows and buffaloes should have a sound udder. This applies especially to the high yielding animals as their udders become particularly prone to infection and inflammation because of the physiological stress of heavy milk production. Control of mastitis should, therefore, be a matter of concern for all dairy development enterprises.

35.5.32 Extensive bacteriological studies conducted on a large number of herds in various parts of the country revealed that the incidence of mastitis has already become a serious problem for the dairy industry¹. According to an estimate made in 1962 there is an annual loss of about Rs. 52.9 crores from this disease alone². As the dairy industry develops and high-yielding milch animals grow in numbers mastitis is likely to cause still greater havoc. Once the infection becomes established in a herd, it is very difficult to get rid of it. Mastitis not only affects yield of milk adversely, but in some cases its chemical composition may be so altered due to the action of mastitis microorganisms, as to render it unsuitable for preparation of certain milk products. Very substantial economic loss results from these effects of mastitis. Furthermore, the residues of several patent antibiotics and chemotherapeutic agents commonly used in the treatment of mastitis may create public health problems and render milk from such treated animals unsuitable for preparation of milk products like cheese. The pathogenic microorganisms and the toxins in milk from animals with mastitis can also be a potential danger to human health unless the milk is boiled before use. In view of these considerations systematic control of mastitis as a national programme is of urgent necessity.

35.5.33 Control : Researches conducted under the auspices of the ICAR have already provided information on the different micro-

1 ICAR. 1954, 1956, 1957, 1958, 1959. *Annual Progress Reports of the Scheme for the Investigation of Mastitis in India for the years 1953-54, 1955-56, 1956-57, 1957-58, 1958-59.* Indian Council of Agricultural Research, New Delhi.

2 Dhanda, M. R. and Sethi, M. S. 1962. *Investigation of Mastitis in India.* Res. Ser. No. 35, p. 3. Indian Council of Agricultural Research, New Delhi.

organisms responsible for mastitis in India. Important guidelines for treatment and control of mastitis under local conditions have also been laid down. What is needed now is an effective organization to implement the programme.

35.5.34 We suggest that a well-equipped laboratory exclusively for mastitis work should be established in each State. For field work, examination of milk samples from suspected mastitis cases may be undertaken at the veterinary hospitals and the chain of diagnostic laboratories that we have suggested in Section 2. It may, however, be necessary to establish some additional diagnostic laboratories in the intensive dairy development areas as the number of milk samples required to be examined in these regions will be large and the veterinary hospitals and other diagnostic laboratories may not be able to cope with this work in addition to their other responsibilities.

35.5.35 Mastitis among indigenous cattle and buffaloes commonly occurs in an insidious or subclinical form. The owners of affected cows/buffaloes may thus not be able to appreciate directly the economic loss inflicted by the disease. Livestock owners can recognise only visibly affected udders and milk. Implementation of control measures for the insidious cases which will form a far larger percentage of the affected animals than the clinical cases will, therefore, pose serious practical difficulties. To overcome this great impediment, a massive audiovisual programme should be launched to educate livestock owners regarding the economic gains that will accrue from the mastitis control campaign.

35.5.36 The total number of cows and buffaloes to be screened for mastitis would be very large and it may not be economically feasible to set up a government organisation to undertake routine clinical examination of the large population of dairy animals. Direct involvement of livestock owners is, therefore, necessary for the success of the programme. With a little training, dairy farmers should be able to use the simple strip-cup test as a routine measure to detect cases of mastitis and report to the nearest veterinarian. The veterinarian will then arrange for professional examination and treatment of the animals through mobile laboratories and clinics.

Haemorrhagic Septicaemia (Pasteurellosis)

35.5.37 No satisfactory vaccine to confer a suitable grade of immunity against haemorrhagic septicaemia (HS) was available in the country till the adjuvant vaccine was developed in 1954. With large scale use of this vaccine in the field, the incidence of the disease is gradually coming down. The average annual figures in respect of

numbers of outbreaks, animals affected, and deaths during 1949—1953 i.e., before the development of the adjuvant vaccine, and the corresponding figures for 1962—1973 i.e., when adjuvant vaccine was used on a large scale are given below²:

Number of	(1949—1953)	(1962—1973)
Outbreaks	7,300	6,223
Animals affected	43,000	25,770
Deaths	33,700	18,265

From the above data it is obvious that following the use of adjuvant vaccine there has been a decline in the number of outbreaks, animals affected and deaths due to the disease. The decrease is to the extent of 15 per cent in the number of outbreaks, 40 per cent in the number of animals affected and 46 per cent in the number of deaths. This progress is fairly satisfactory, but better success in the control of HS could have been achieved, had vaccinations been carried out more systematically and extensively. We have been informed that the organised farms which are carrying out regular annual vaccinations seldom lose animals from the disease. There is need for a systematic vaccination programme in the endemic areas. For this purpose, each State should prepare epidemiological maps indicating the endemic areas of HS, and all cattle and buffaloes in such areas should be regularly vaccinated every year before the onset of monsoon.

Anthrax

35.5.38 Anthrax is still taking on an average an annual toll of about 2,400 head of cattle and buffaloes in the country. This has been revealed by analysis of data concerning incidence of outbreaks during 1962—1973³. Besides the toll of cattle and buffaloes, a large number of sheep, goats and pigs also die of the disease, though the exact figures of the mortality in these species of animals are not available. Death of livestock in such numbers is no doubt a matter of concern but much more serious is the great loss that the export trade in bones, hides and skins is suffering as a consequence of the wide prevalence of the disease in the country. Several countries do not accept these products from India because of the prevalence of the

1 Dhanda, M. R. Das, M. S. Lall, J.M. and Seth, R. N. 1956. Immunological studies on *Pasteurella septica* I Trials on Adjuvant Vaccine Indian J. Vet. Sci. 26 : 273—84.

2 Ministry of Food and Agriculture (ICAR), Government of India, *Animal Health Information Service: Contagious Diseases Bulletins for the years 1949—53 and 1962—66*. Ministry of Agriculture (ICAR), Government of India, New Delhi.

3 Ministry of Food and Agriculture, Government of India, *Animal Health Information Service: Contagious Diseases Bulletins for the years 1962—66*. Ministry of Agriculture (ICAR), Government of India, New Delhi.

disease. Besides these considerations cognizance need be taken of the fact that anthrax being a communicable disease to man it creates a public health problem. The average number of annual outbreaks, attacks and deaths among cattle and buffaloes due to anthrax during 1962—67 and 1968—73 are given below :

	(1962—1967)	(1968—1973)
Outbreaks	566	562
Animals affected	3,659	2,858
Deaths	2,648	2,192

It is obvious from the above data that in the control of anthrax for which a highly effective vaccine is readily available the progress made during the last 12 years is by no means significant. To control anthrax there is need for a more systematic vaccination programme in endemic areas. This should be carried out on the lines advocated for haemorrhagic septicaemia.

Black-quarter

35.5.39 Black-quarter (BQ) is killing annually as many as 10,430 cattle and buffaloes in India as assessed by analysis of the data on outbreaks of the disease during 1962—1973¹. Earlier to the development of a potent vaccine in 1951, this disease was on an average taking an annual toll of 21,500 animals². Compared to this figure the reduction of annual mortality to 10,430 cattle and buffaloes may be considered as some achievement. The incidence of mortality has not shown any further appreciable decline during the last 12 years. It may be due to the fact that the vaccination programme is not being pursued as vigorously as was done soon after the development of the potent vaccine. We are informed that in organised cattle farms where regular annual vaccination is carried out there is practically no mortality in the stock due to this disease. In light of this we are of the view that if systematic vaccination is carried out in endemic areas it should be possible to reduce the incidence substantially. Since about 85 per cent of the outbreaks of BQ occur in Karnataka, Tamil Nadu, Andhra Pradesh and Maharashtra, a more intensive and systematic vaccination campaign should be instituted in these States.

1 Ministry of Food and Agriculture, Government of India, *Animal, Health Information Service : Contagious Diseases Bulletins for the years 1962—1973*. Ministry of Agriculture (ICAR), Government of India, New Delhi.

2 CSIR. 1970. *The Wealth of India : Raw Materials*. Vol. VI, *Supplement Livestock* p.40. Council of Scientific and Industrial Research, New Delhi.

Contagious Bovine Pleuro-Pneumonia

35.5.40 The first authentic record of contagious bovine pleuro-pneumonia (CBPP) in India was in 1940 in Assam. Since then the disease has remained confined only to that State apparently because its poor quality indigenous cattle which have practically no out-of-State sale opportunities. With the developing transport facilities and the livestock improvement programmes taken up recently in Assam, some movement of animals to neighbouring States has already started. It is, therefore, very important that CBPP should be eradicated from Assam as quickly as possible. Otherwise the infection may spread to other areas of the country, and control of the disease would then become a very serious problem.

35.5.41 Control : The control measures followed so far consist of (a) isolation of the affected, suspected and incontact animals; (b) detection of carrier animals by serological tests and their isolation ; and (c) preventive inoculation with a vaccine prepared from an attenuated strain of the casual organism, *Mycoplasma mycoides*. An analysis of data on morbidity and mortality of cattle caused by CBPP during 1953 to 1973 has shown that although these control measures have considerably reduced the incidence of the disease they have failed to bring about eradication of the infection. It is rather disappointing that even in 1973, i.e., after 22 years of operation of the control programme, as many as 38 outbreaks occurred in two districts of Assam.

35.5.42 The mortality from CBPP came down to about 27 deaths in 1961-62 as compared to 1,036 in 1956-57. The mortality again showed an increase, there being 138 deaths in 1970 and 173 in 1973. This is a definite setback to the control programme. We recommend that a Committee of Animal Disease Specialists be constituted immediately to carry out a thorough on-the-spot study of the factors responsible for the increase in mortality due to CBPP and lay down a systematic policy for its eradication within the shortest period. The presence of foci of this infection poses a serious threat to the developing dairy industry not only in Assam but also in other States. A final thrust should be made to wipe out the infection from the existing pockets. For achieving this, the strategy of control of the disease requires to be modified. The new approach should be to adopt a stamping-out policy, i.e., destruction of affected animals as well as of serologically positive ones with payment of compensation. Further, the movement of animals from across the borders should be strictly regulated and quarantine measures tightened. It should also be ensured that no animal from the infected areas is allowed to move to the areas free from the disease.

Fascioliasis (Liver fluke Disease)

35.5.43 Fascioliasis is widely prevalent in India and is one of the major limiting factors in the improvement of cattle in marshy and waterlogged areas both in the plains and the hilly regions. In *Fasciola* endemic areas as many as 90 per cent of the animals may be affected. In an extensive study in the erstwhile princely State of Hyderabad (Deccan) it was found that due to fluke infestation the average working life of cattle was reduced as low as two to three years¹. The incidence of the disease in Karnataka is likewise high where as many as 1,18,892 animals were treated with anti-liver fluke drugs during a single year². A survey conducted in Jammu and Kashmir revealed that *Fasciola* infestation was present all over Kashmir valley and the irrigated parts of Jammu province³. The incidence of the disease in Bihar, Andhra Pradesh, Orissa, Himachal Pradesh, Uttar Pradesh, West Bengal, Assam and parts of Madhya Pradesh is also serious.

35.5.44 Control : In view of the serious effect of the disease on the health and productivity of livestock, liver fluke control programmes were taken up in the erstwhile princely State of Hyderabad and in Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh, Karnataka, Bihar and Orissa, but these had little impact in reducing the incidence of the disease. The reason may be that the control measures were implemented in a half-hearted manner or were not sustained over a sufficiently long period. Admittedly, the control of a parasitic disease like fascioliasis in which snails act as intermediate host is extremely difficult in a vast country where marshy and waterlogged areas extend over long terrains. Nevertheless, the situation has to be faced and systematic programme for control of fascioliasis has to be launched, as otherwise improvement of livestock cannot be achieved in large *Fasciola* endemic tracts of the country.

35.5.45 It appears that the chief bottleneck in the control programme is lack of cooperation from livestock owners. Animals harbouring comparatively light infestation with flukes may not exhibit any apparent symptoms of the disease and the owners are reluctant to get their animals dosed with antihelminthic drugs, especially when some of the treated animals may show untoward reactions. Recently, some new drugs (hexachlorophane, oxyclozanide, menichlopholan, nitroxynil and olixanide) have been developed and are claimed to be highly efficacious against both mature and immature flukes and are quite safe for the animals.

1 Mahajan, M.R. 1942. Liverfluke and its control in Hyderabad State. *Indian J. vet. Sci.* 12 : 133.

2 Progress Report of the Scheme for the Control of Liverfluke Infestation, Mysore, 1956-57 and 1957-58.

3 *Coordination of Animal Health Research in India*. Pt. I, p. 60. Indian Council of Agricultural Research, New Delhi.

35.5.46. Most of the programmes undertaken in the past did not make any appreciable progress in the control of the disease because of lack of active cooperation from the livestock owners, and not because of any active hostility against these programmes. To overcome this, livestock owners will have to be educated with the help of massive audio-visual programmes to convince them how this scourge is insidiously causing degeneration of their livestock.

35.5.47 The control programme would involve large-scale surveys to delimit the endemic areas in each State. We are not in favour of appointing any special squads for this work as that would be very expensive. We suggest that in each of the States where fascioliasis is a serious problem, one Liver Fluke Control Officer should be appointed to get the survey and control work done through the network of the existing veterinary dispensaries and hospitals. In Section 2, we have proposed that the number of veterinarians should be progressively increased. We have also suggested that every veterinary dispensary and hospital should be provided with a microscope and reagents for carrying out routine clinical examinations. With the implementation of these recommendations it should be easy to undertake liver fluke surveys and control programme without appointing additional staff. The spraying of molluscicides can also be organised by mobilising the village level workers and the farmers during the operation of the campaign.

35.5.48 We are of the opinion that with available drugs and technical know-how the disease can be successfully brought under control. What is needed is active participation of the livestock owners. No governmental organisation, however large, can possibly undertake the gigantic task of fencing the snail-infested ponds and pastures, destroying the snails, draining or filling shallow marshy areas to render them inhospitable to snails, collecting faecal samples regularly from the animals for microscopic examination, looking after the ducks etc. that may be introduced for biological control of snails. Once the livestock owners are convinced of the usefulness they would wholeheartedly support the control programmes and actively assist the veterinarians in field work.

35.5.49 Research work on fascioliasis, particularly on ecological behaviour of the intermediate host and the effect of different molluscicides on the snails and the environment, should be intensified. New molluscicides which are not affected by the organic matter of ponds and pastures are coming into the market. These should be tested under field conditions to find out the most suitable molluscicide for liver fluke control programme. Similarly, the various drugs that are being marketed for treating fascioliasis in domestic animals should be

subjected to carefully controlled trials to pick up the most effective and safe drug for field application. The State Animal Husbandry Departments should give priority to duck-raising programmes in the fluke-infested areas as a step towards the biological control of snails.

Warble Flies

35.5.50 Warble infestation causes serious damage to raw hides and skins. According to one assessment made 15 years ago the monetary loss on this account was not less than one-tenth of the total value of hides and skins produced in the country¹. Besides the warbles adversely affect the well-being of the infested animals and bring about reduction in the milk yield of lactating animals. Large tracts in Punjab, Haryana, Uttar Pradesh, Rajasthan, Western Bihar, parts of Jammu & Kashmir and the western part of Himalayan range are heavily infested with warble flies and the infestation is also spreading to other parts of the country.

35.5.51 In view of the serious loss suffered by the livestock industry we suggest that a systematic programme for control of warble fly infestation be taken up at an early date. The most suitable method for reducing losses inflicted by the warble fly is the destruction of eggs by the singeing of hair on the legs of the animals during the egg-laying season and systematic administration as well as local application of organophosphorus larvicides like trichlorophon, conmmaphos and ruelene. It is also important to check the spread of warble infestation to free areas. This can be achieved by educating livestock owners on the risks of importing animals from warble infested zones without proper veterinary inspection and advice. Efforts should be made to enlist the voluntary cooperation of livestock owners for controlling the movement of animals from warble-infested to warble free areas. However, if at some stage it becomes necessary to take the help of some legislative measures, recourse may be taken to the Act proposed in paragraph 35.6.2 for regulating the interstate movement of livestock.

Theileriasis

35.5.52 Theileria infection in cattle has long been known to be prevalent in India, but its real impact has been felt only recently with importation of exotic cattle in large numbers and the introduction of crossbreeding programmes on an extensive scale. Indigenous cattle

¹ Sori, B.N. 1960. *Biological Factors Affecting Hides and Skins in India*. Anim. Husb. Ser. No. 1, p. 5. Indian Council of Agricultural Research, New Delhi.

are somewhat tolerant to local strains of *Theileria* but imported adult stock is highly susceptible to some of these strains. Several State Directors of Veterinary Services have informed us that theileriasis has been their biggest problem with the exotic animals as no specific treatment for established clinical cases is available. Suitable prophylactic vaccine has also not yet been developed against the *Theileria* strains prevalent in India. The tissue culture vaccines used in Iran and Israel have not been found to give satisfactory protection against the strains found in India. There is, therefore, an urgent need for intensification of research on this disease with particular reference to the study of the antigenic make-up of the local *Theileria* strains and for development of an efficacious prophylactic vaccine. Research work should also be undertaken to develop simple serological tests which could easily be applied in the field for detection of early and latent cases. A large number of compounds claimed to be effective against *Theileria* infection have recently been put up in the market by some reputed pharmaceutical firms. The relative efficacy of these should be determined under carefully controlled conditions in research institutes and agricultural universities having proper facilities for such studies. The results of comparative trials should be made known as early as possible so that the field veterinarians may select the most suitable drug for treatment of the disease.

Sheep Pox

35.5.53 Among the infectious diseases of sheep, sheep pox is the most serious disease in the country. The average number of annual outbreaks was 236 during 1962—67 which increased to 439 during 1968—73¹. The foci of the infection are spread all over the country and the outbreaks occur throughout the year. Now that the sheep development programmes have been taken up on an extensive scale, systematic control of sheep pox is very important. One serious epidemic may wipe out several flocks of improved breeds thereby causing a heavy economic loss and a major setback to the sheep development programmes. Unfortunately, the live sheep pox virus vaccine now being produced in the country has not been very effective in protecting sheep against the disease. Recently, the IVRI has prepared some brews of an inactivated sheep pox virus vaccine according to the Russian method. This vaccine is reported to have given good results under laboratory as well as field conditions. Production of this vaccine does not require any special technique or sophisticated

¹ Ministry of Food and Agriculture, Government of India. *Animal Health Information Service : Contagious Diseases Bulletins for the years 1962—73*. Ministry of Agriculture, Government of India, New Delhi.

equipment. We, therefore, recommend that its large-scale production should be undertaken immediately at all the biological production centres and the vaccine should be used for prophylactic immunization of sheep till a better product becomes available. In the meantime, research work should be intensified at the IVRI and at other suitable centres for developing a more efficacious vaccine.

Rabies

35.5.54 Rabies has been successfully controlled in several western and some eastern countries, whereas its incidence is showing a steady increase in India¹. It has been estimated that annually on an average 15,000 human beings succumb to this fell disease and more than 3,00,000 persons have to undergo anti-rabic treatment every year accounting for an annual labour loss of 4.2 million man-days². Analysis of the data pertaining to the source of rabies infection in human beings in India shows that practically all the cases are from bites of dogs, cats, jackals, wolves, foxes, mongoose and hyenas. So far there is no evidence to establish that wild rats, mice or bats, which are considered important reservoirs of the infection in some countries, have a significant role in the dissemination of the infection in India³.

35.5.55 Apart from the high incidence of rabies in human beings and dogs, the disease has also been recorded in cats, horses, donkeys, cattle and camels. There are reports of incidence of rabies in groups of horses without any history of apparent bite by a rabid animal⁴. This is a peculiar feature and raises an important epizootiological point needing thorough investigation of the source of rabies infection in horses and its mode of spread.

35.5.56 Very little systematic work to control rabies in animals has so far been carried out in India. Even the accepted routine public health measures, viz., vaccination and licensing of pet dogs and destruction of stray dogs are being practised in a half-hearted manner. Thomas¹ has rightly observed that "apathy regarding the problem of rabies has reached a stage where further delay may lead to grave consequences. Once the virus spreads to bats or to rodents, it

1 Thomas, A.K. 1968. Viral and Rickettsial Zoonotic Diseases. Paper presented at the National Seminar on Zoonoses in India, National Institute of Communicable Diseases, Delhi.

2 Rai Chowdhuri, A.N. and Thomas, A.K. 1971. *Principles and Practice of Antirabic Treatment and Control of Rabies*. No. 101 B Central Research Institute, Kasauli.

3 Rai Chowdhuri, A.N. and Thomas, A.K. 1967. *Rabies: General Considerations and Laboratory Procedures*. Special Report Series No. 58. Indian Council of Medical Research, New Delhi.

4 IVRI. 1955, 1963. Annual Scientific Reports of the Division of Pathology and Bacteriology, Indian Veterinary Research Institute, Mukteswar—Kumaon for the years 1955 and 1963. Annual Scientific Report of the Division of Bacteriology and Virology, Indian Veterinary Research Institute, Mukteswar—Kumaon for the year 1968.

will be well nigh impossible to control the disease in a country like India". We recommend that effective measures for control of rabies be immediately undertaken. The programme may be launched by the State Veterinary Departments during the Fifth Five Year Plan in the capital of each of the States/Union Territories and it may be gradually extended to other cities and towns in the subsequent Plan periods till the whole country is covered.

Swine Fever (Hog cholera)

35.5.57 Swine fever was not recorded in India till 1960. There is a view that the disease got introduced in the country with pigs imported during 1961-62. For several succeeding years the disease caused heavy mortality among pigs. In 1967, about 5,000 pigs died of swine fever in the Car Nicobar Island alone. However, as a result of large scale vaccination with crystal violet inactivated vaccine and lapinised virus vaccine the disease has been brought under control. It is heartening to observe that during 1972 and 1973 no outbreak of swine fever was reported¹. It is understood that in 1974 there have been some cases of swine fever in Nagaland and Meghalaya. There cannot, therefore, be any sense for complacency.

35.5.58 Control : Should an outbreak occur in future in any State other than Meghalaya and Nagaland, stamping-out-policy, i.e., destruction of infected and incontact pigs and ring vaccination around the scene of outbreak be followed. In case of Meghalaya and Nagaland, if the disease still persists and if the foci of infection have spread prophylactic mass vaccination programme should be undertaken without delay.

35.5.59 Till the time Meghalaya and Nagaland are absolutely clean of swine fever infection, free movement of pigs from these States to other parts of the country should not be allowed. However, if for very special reasons it becomes absolutely necessary to take some pigs out of Meghalaya and Nagaland to other States they should be vaccinated against swine fever and quarantined for at least 15 days before being moved out.

35.5.60 In order to meet any future emergency it should be ensured that adequate quantities of lapinised swine fever vaccine are stored all the year round at Izatnagar, Hissar, Ranipet and Calcutta where the vaccine is being manufactured at present. We further suggest that the Biological Products Station at Gauhati should undertake the production and storage of this vaccine since extensive pig development

¹ Ministry of Food and Agriculture (ICAR), Government of India, 1968. *Animal Health Information Service : Contagious Diseases Bulletins for the years 1972 and 1973*. Ministry of Agriculture, Government of India, New Delhi.

work has been taken up in the north-eastern region of the country.

35.5.61 As swine fever is almost wholly under control, quarantine regulations should be rigidly followed in the case of all pigs imported from abroad. It will also be worthwhile to investigate if wild pigs or some other non-swine reservoirs of this infection exist so that appropriate action may be taken for the elimination of the swine fever virus and for checking its spread to domestic pigs.

Ranikhet Disease

35.5.62 Prior to the evolution of a highly efficacious vaccine against Ranikhet disease (RD) in 1942, this disease was so widespread and devastating in its effects that poultry raising on a commercial scale could not even be thought of. It is gratifying to note that following the successful use of the RD vaccine the incidence of the disease has got drastically reduced. At present about 1,150 outbreaks occur annually¹.

35.5.63 A comparison of the number of annual outbreaks of RD with mortality amongst the infected birds during 1969—73 and 1964—68 has shown that the number of annual outbreaks has remained more or less the same while the rate of mortality has gone down considerably. There were on an average 7,519 deaths a year in 1969—73 due to RD as against 10,724 in 1964—1968. Mortality rate for outbreaks during 1969—73 works out 6.5 as against 9.5 for 1964—68. This is a notable achievement, especially in view of the large increase in the poultry population.

35.5.64 Control : Analysis of the pattern of RD outbreaks over the last ten years shows that sporadic outbreaks continue to occur throughout the year in various States. We think that under the prevailing conditions of poultry husbandry the only practical approach to contain the infection is to intensify the vaccination programme. Keeping in view the large poultry population and equally large replacement of birds (about 140 million), and the total quantity of Ranikhet disease vaccine produced in the country about 65.6 million doses, it is evident that a large percentage of poultry population remains without a vaccination cover. For bringing down RD infection to an insignificant level, it is necessary to raise the target of vaccination to cover at least 80 per cent of the poultry population within a couple of years and to maintain this level of vaccination target for a period of about

¹ Ministry of Food and Agriculture (ICAR), Government of India. *Animal Health Information Service : Contagious Diseases Bulletins for the years 1964—66 and for the years 1967—73*. Ministry of Agriculture, Government of India, New Delhi.

10 years. At that stage it would be worthwhile to start a pilot project in some selected areas, where vaccination may be stopped and reliance placed on hygienic and sanitary measures for keeping the poultry farms free of the disease. Should an outbreak occur in such an area, stamping-out policy be followed. If this approach proves successful, the programme should be gradually extended to bring more and more poultry farms in contiguous areas under its orbit till the whole country is covered.

35.5.65 Intensification of the vaccination programme recommended above would necessitate stepping up the production of RD vaccine. At present, the R₂B strain vaccine is being produced in 14 biological production centres in the country, all of which have the required facilities to double or even treble their production. The milder F strain RD vaccine is being produced only at three centres, but there is no special technical difficulty in its production at other centres. We suggest that each State should form RD vaccination squads equipped inter alia with vehicles for quick mobility. Further, all commercial hatcheries should be licensed and vaccination of all day-old chicks with F strain vaccine made obligatory. These chicks should be re-vaccinated with Mukteswar R₂B vaccine at 8 week's age. Should some other more efficacious vaccines become available later, these should be used. Every case of breakdown in immunity among vaccinated birds should be thoroughly investigated and prompt remedial measures taken.

Marek's Disease

35.5.66 This devastating disease struck many organized poultry farms in an epidemic form in 1969 and the greatest havoc cause in Maharashtra. The acute form of Marek's disease is now widely prevalent in the country and is causing a mortality of even upto 38 per cent in some farms¹. A recent survey of 16 organized farms in Punjab, Haryana, Uttar Pradesh and Delhi showed that 14 of these were having Marek's disease infection².

35.5.67 No systematic investigation has so far been carried out to ascertain how this disease became such a serious problem within the last five years. There is a view that a virulent strain of Marek's disease virus got introduced into some of our hatcheries through inadvertent importation of infected birds from abroad, and the contagion spread far and within a very short time through large scale

¹ Rajaya, B. S. and Mohantray, G. C. 1971. Annual Symposium, All-India Poultry Science Association, Bangalore.

² Sahota, P.S. 1973. Incidence of Marek's disease in India *Indian Poult. Rev.* 4 : 777.

distribution of chickens from infected hatcheries. As Marek's disease had not earlier been a problem, the requisite biologicals to combat this scourge were not being produced in the country. The result was that once the disease struck the poultry industry in a virulent form it caused heavy economic losses and in some States like Maharashtra a number of well-organized farms were threatened with closure.

35.5.68 Control : Since Marek's disease is highly contagious and has already spread over wide area, isolated attempts to control the infection in the different regions of the country are not likely to succeed. It appears to us that without a systematic programme to control the disease throughout the country the poultry industry cannot be saved from the ravages of this disease. We, therefore, recommend that a National Programme for its control with the ultimate objective of its eradication should be initiated immediately on the following lines :—

- (i) A rapid field survey should be undertaken by the State Poultry Disease Investigation Officers in collaboration with the agricultural universities and the IVRI to delineate the infected from the clean areas. Rigorous steps should then be taken to ensure that the disease does not gain entry into the clean areas. This may be achieved by adopting strict quarantine and sanitary measures and by licensing the hatcheries and controlling the movement of the birds. In the case of flocks infected heavily with Marek's disease virus, all the birds should, if possible, be destroyed immediately and suitably disposed of under proper veterinary supervision and the premises should be thoroughly disinfected. However, in the case of farms having valuable birds of superior germplasm, where it may not be possible to destroy them, all the day-old chickens hatched at such farms should be vaccinated with a suitable vaccine. They should then be reared in clean premises.
- (ii) It will be necessary to bring Marek's disease under the Contagious Disease Act so that the State Animal Husbandry/ Veterinary Departments may have sufficient legal powers to enforce the above measures.

35.5.69 Since Marek's disease vaccine is not being produced at present anywhere in India, it will have to be imported from abroad till it can be manufactured indigenously in sufficient quantities to meet the total demand. At present three types of vaccines for control of Marek's disease are in use in other countries. There are (a) apathogenic Marek's disease virus vaccine; (b) attenuated Marek's disease virus vaccine and (c) turkey herpes virus vaccine. In 1972, the

Division of Animal Husbandry, Union Ministry of Agriculture and Irrigation decided that only the turkey herpes virus vaccine should be imported. We endorse this decision, and recommend that import of no other type of vaccine should be permitted unless its efficacy and safety are well established.

35.5.70 Complete records pertaining to mortality and productive performance of the vaccinated birds should be maintained at farms where vaccination is resorted to and these data should be carefully analysed by a Committee of Experts which may be appointed by the Government of India for finding out the effectiveness of vaccination as a method for control of Marek's disease.

35.5.71 In order to conserve foreign exchange, manufacture of turkey herpes virus vaccine should be taken up immediately in our biological production centres in order to meet the entire requirements in the country. The IVRI in particular should expedite its production to make the vaccine available without any further delay.

35.5.72 Research work on this disease should be intensified at the IVRI and some agricultural universities. Particular attention may be paid to the study of epizootiology of the disease, factors relating to virus shedding, viability of the virus under field conditions and development of a more effective vaccine which could prevent the establishment of infection.

Chronic Respiratory disease (Avian respiratory mycoplasmosis)

35.5.73 The first authentic isolation of pleuro-pneumonia like organism (PPLO) from poultry, the causal agent of chronic respiratory disease (CRD), was reported in India in 1959. Since then CRD has been reported from almost all the States. In a random serological testing of 31,641 sera samples during 1968—74 in different poultry farms of the country, 14,770 (47%) gave positive reaction. More disturbing was the observation that out of 295 poultry farms subjected to the serological surveys in 24 States/Union Territories, as many as 253 (86%) were found to have avian respiratory mycoplasmosis infection¹. Thus, CRD has become one of the most serious poultry diseases in the country. Although mortality from this scourge is not high, it is causing substantial losses due to lowered production, poor hatchability, reduced feed conversion, and retarded growth rate. Systematic control of CRD with the ultimate objective of its eradication is, therefore, of great importance for the success of the poultry industry.

¹ ICAR. 1974. *Final Report of the Project Coordinator of the Indian Council of Agricultural Research, All-India Coordinated Project for Research and Investigation into the Respiratory Diseases of Poultry and Their Control for 1968—1974.*

35.5.74 Control : Until recently even the antigen for serological diagnosis of the infection was not being prepared at any of our biological production centres. Due to non-availability of the antigen, the disease could not be detected in its early stages and the infection thus continued to spread widely. However, the production of this antigen has now been taken up at the IVRI. Its production should also be taken up by some more biological production centres as suggested in paragraph 35.4.3 so that adequate quantity of the antigen may be available at a very early date for launching a national programme for control of the disease.

35.5.75 In our opinion, test and slaughter of reactors with adoption of strict sanitary measures may prove to be the most practical method for elimination of the infection. However, in case of some farms that may be having valuable breeding stock, it may be uneconomic to follow this procedure. In their case treatment of positive reactors and of eggs with effective antibiotics/chemo-therapeutic agents coupled with enforcement of rigorous hygienic measures with the ultimate objective of building up PPLO free flocks may prove more advantageous and rewarding. While dealing earlier with the control of Ranikhet disease we suggested that special squads may be formed for carrying out mass vaccination against RD. The serological testing for CRD can also be simultaneously done by these teams.

Pullorum Disease

35.5.76 Pullorum disease is presently confined to a few small pockets and most States are free from this infection. Now is, therefore, the most appropriate time to launch a National Pullorum Eradication Campaign to stamp out the disease and to take strict regulatory steps to ensure that the disease does not spread from the existing foci or gain fresh entry from exotic sources. We recommend that the eradication programme may be initiated during the Fifth Plan with an aim to complete the work before close of 1980.

35.5.77 While dealing earlier with Ranikhet disease we had suggested that each State should set up vaccination squads for carrying out large scale immunization of chickens against the disease. The same teams, while undertaking vaccination work, can carry out agglutination tests against pullorum infection. The farms without previous history of pullorum disease and proving negative to the agglutination tests may be certified as 'pullorum clean flocks' following the procedure indicated later. If any reactor is found in any flock, it should be destroyed immediately and the hatching incubators and the farm premises thoroughly disinfected. The serological agglutination tests should then

be repeated every month until no more reactors are detected on two consecutive tests. Such a flock may then be certified as 'pullorum passed flock' and should be retested after six months. If still no reactor is detected, it may be certified as 'pullorum clean flock'. The certificates of 'pullorum clean' and 'pullorum passed' flocks should be granted jointly by the Director of Veterinary Services of the respective State and the Joint Commissioner (Livestock Health) in the Animal Husbandry Division of the Union Ministry of Agriculture and Irrigation.

35.5.78 Under the Livestock Importation Act it has been stipulated that "poultry imported into the country has to be accompanied by health certificates stating that the adult poultry birds which are either themselves being exported or from which day-old chicks or immature chickens are included in the consignment were subjected to agglutination test for pullorum disease with negative results immediately prior to embarkation. The certificate should also state that the flocks, from which the consignment of poultry is drawn, have been regularly inspected by a Government Veterinary Officer over a period of not less than three months and that day-old chicks contained in the consignment have not been in contact with any adult birds. Further, the certificates prescribed under the rules are required to give a written declaration that the chicks were (a) hatched in an incubator in which no eggs from infected birds had been hatched and that the incubator was properly fumigated and disinfected prior to hatching, and (b) packed direct from the incubator into new boxes for export and that there was no contact with any birds other than day-old chicks. The imported birds are required to be kept under observation for a period of at least 21 days and the imported chicks for a period of 56 days on the importers' premises". These measures, if followed scrupulously, should ensure reasonable safeguards against the introduction of exotic pullorum infection. We are of the opinion that by carrying out the National Pullorum Eradication Campaign in the manner suggested above and by following the quarantine rules and regulations prescribed under the Livestock Importation Act, it should be possible to eradicate pullorum infection from the country within five years.

Duck Virus Hepatitis

35.5.79 Duck virus hepatitis (DVH) has been a major killer of imported ducks and it wiped out several consignments of Khaki Campbell ducklings. This has caused a great scare among the duck breeders, which is comparable to the hapless condition of the poultry farmers before Ranikhet disease vaccine became available. At present no biological either for active or passive immunization of ducks is produced in the country.

35.5.80 Outbreaks of DVH have been reported abroad even at farms under excellent management and sanitary conditions. At present, the only rational method to prevent the losses due to DVH is to carry out prophylactic immunization. As such, a suitable vaccine strain should be imported from abroad and DVH vaccine should be produced in our biological production centres. It may also be worthwhile to prepare hyperimmune serum for treatment of the affected ducks. Since experience in the manufacture of vaccines and antiserum against DVH seems to be lacking in the country, it may be necessary to depute a few officers to the Duck Disease Laboratory at Eastport, Long Island, USA, or some other suitable Institute to learn the technique of production of these biologicals.

Deficiency Diseases

35.5.81 Vast majority of animals in India manifest subclinical syndromes of deficiency diseases in a complex form resulting from an overall low intake of nutritional substances. Hence the main problem is to bridge the wide gap that exists between the availability of the feeds and fodders and the nutritional requirements of the livestock population of the country.

35.5.82 Deficient nutritional status has an adverse effect on growth, reproduction and production of the livestock. Nutritional deficiencies are also reflected in the form of vague, non-specific signs of degeneration of animals. With the launching of extensive livestock development programmes in the country the impact of this overall acute shortage of feeds and fodders will be felt all the more seriously. In order to save the livestock from further degeneration, augmentation of production of animal feeds and fodders and reduction of the number of unproductive and uneconomic of stocks are absolutely essential. This aspect has been elaborated under Chapters 34 and 28 on Livestock Feeding and Cattle and Buffaloes respectively.

Other Important Diseases

35.5.83 Specific disease problems of sheep, camels and wildlife have been discussed in Chapters 30, 32 and 44 on Sheep and Goats, Other Livestock and Forest Ecology and Wildlife Management respectively. In addition to the disease control programmes discussed in all these Chapters, it is necessary to undertake systematic control of diseases like Johne's disease, enterotoxaemia, babesiosis, anaplasmosis, schistosomiasis, amphistomiasis, coccidiosis, lungworm infestation, contagious

caprine pleuro-pneumonia, fowl pox, fowl spirochaetosis, fowl typhoid etc.

Implementation of Disease Control Programmes

35.5.84 The major responsibility for control of animal diseases lies with the State Governments. However, in case of certain diseases, which are of special importance for the developing livestock industry of the country, it would be necessary to undertake nation-wide campaigns for their control on the lines of the Rinderpest Eradication Programme. In this context, we recommend that National Programmes financed wholly or partly by the Government of India should be taken up immediately for the systematic control and eradication of the diseases mentioned below :

- (a) Foot-and-mouth disease
- (b) Tuberculosis
- (c) Brucellosis
- (d) Contagious bovine pleuropneumonia
- (e) Pullorum disease
- (f) Marek's disease

35.5.85 In the case of Rinderpest Eradication Programme, we have earlier recommended in paragraph 35.5.7 that the Central Government may continue to finance this programme till 1985, and thereafter the State Government may be wholly responsible for its implementation. As for the remaining diseases, it should be the responsibility of the State Veterinary Departments to intensify measures for their systematic control and eradication, wherever possible.

35.5.86 The Joint Commissioner (Livestock Health) in the Animal Husbandry Division of the Union Ministry of Agriculture and Irrigation should analyse periodically the trends in the incidence of the diseases and the progress achieved in their control on a country-wide basis and keep the States informed.

6 LEGISLATION FOR CONTROL OF ANIMAL DISEASES

35.6.1 In order to prevent ingress of exotic infections and to ensure effective check against spread of the infectious diseases in the country, the Livestock Importation (Amendment) Act, 1953 need be modified in the manner indicated below. It will also be necessary to enact suitable legislation for controlling the interstate movement of livestock. The import of livestock is regulated under, the provisions of the

Livestock Importation Act, 1898, as amended by the Livestock Importation (Amendment) Act, 1953. This Act empowers the Central Government to regulate, restrict or prohibit the import of livestock into the country. Though the imports are regulated under the Central Act, the Rules for the detention, inspection, disinfection or destruction in respect of imported livestock are framed by the State Governments concerned. In the absence of an enforcement agency at the Central level, the State Governments themselves are responsible for the receipt and movement of imported animals. As a result enforcement of regulations has been somewhat weak and there is lack of uniformity of procedure among the States. Further, no suitable control over the entry of animals for the zoological gardens has been prescribed in this or any other Act. At present the Government of India does not have adequate legal authority to control the import of veterinary biological products, cultures of microorganisms, semen etc. nor are there effective safeguards against the introduction of exotic infections through import of livestock products like eggs, meat, cheese and butter. We make the following suggestions for a more efficient enforcement of the Act :

- (i) The Livestock Importation Act should be suitably amended so that the authority to implement this Act vests with the Government of India.
- (ii) The Livestock Importation Act should be suitably amended to enforce laboratory examinations of imported livestock products like eggs, meat, cheese, butter etc. in order to ensure that these do not introduce exotic infections and are otherwise safe for human consumption.
- (iii) Animals to be imported into the country for zoological gardens should also be brought under the provisions of this Act. For this purpose, no amendment in the Act is necessary as the Government of India is empowered under the livestock Importation (Amendment) Act, 1953, to include any other animal by notification in the official gazette.
- (iv) Regulations should be added to control import of cultures of microorganisms, semen and veterinary biological products like vaccines, sera and diagnostic agents.

35.6.2 Contagious Diseases Acts have been enacted by the State Governments for prevention and control of animal diseases. They appear to be fairly comprehensive to give adequate powers to the State Governments for dealing effectively with the control of animal diseases. However, no suitable legislation for regulating interstate movement of livestock has been enacted so far. In our opinion, a Central agency having powers to control interstate movement of live-

stock is essential as this will help to prevent the spread of diseases from one State to another. We, therefore, recommend that suitable legislation should be enacted for this purpose by the Government of India at an early date.

7 ANIMAL QUARANTINE AND CERTIFICATION

Quarantine

35.7.1 An efficient animal quarantine organisation is essential to safeguard the health of livestock against the exotic diseases. However, in India this very important requirement of animal health has not so far received due consideration and an effective quarantine service is lacking. As a result certain exotic diseases like African horsesickness, swine fever, Marek's disease entered the country in recent years and caused heavy mortality in livestock.

35.7.2 African horsesickness probably entered through the Rajasthan border sometime in April 1960 and spread over wide areas. Despite rigorous control measures it killed 28,230 equines including valuable army, police and race horses before it could be eradicated. Swine fever struck during the early part of 1962 and caused heavy mortality in the pig population. Marek's disease came in during 1969 and has already become so deep-rooted in different parts of the country that its control and eradication have become a serious national problem. A number of other poultry diseases like avian mycoplasmosis, infectious laryngotracheitis, infectious bronchitis, avian listeriosis have also got introduced presumably along with imports of fowls without proper attention to quarantine. Therefore, it is of great importance that an effective animal quarantine organisation be built up immediately.

35.7.3 At present, import of livestock by sea is permitted only through the ports of Bombay, Madras, Calcutta and Cochin and by air through the airports of Delhi, Bombay, Madras, Calcutta, Cochin and Tiruchirapally. Import of animals from the adjoining countries by land routes is prohibited except through Attari on Indo-Pakistan border. At every port, officers of the Customs Department have similar powers in respect of livestock as they have in the case of other articles, the importation of which is regulated, restricted or prohibited by law.

35.7.4 The law pertaining to importation of livestock requires that a livestock should be accompanied by valid health certificates. At the ports, the customs authorities are assisted in examination of the imported livestock and checking of the health certificates by an officer

of the State Department of Animal Husbandry, appointed for the purpose in accordance with the rules framed by the States concerned under the Livestock Importation Act. No central enforcement agency has so far been set up.

35.7.5 The law requires that all imported animals should be detained in quarantine unless accompanied by valid certificates of health, and that in the event of an out break of a disease in transit the consignment should be impounded and detained in quarantine for a period upto 90 days. However, in actual practice the action taken is very often reduced to a mere formality because even the minimum facilities for quarantining the animals have not yet been provided at any of the ports of entry. The result is that consignments of animals received have to be moved to other areas in the mainland for isolation, thus defeating the very purpose for which quarantine rules and regulations are framed. In regard to importation of livestock products, there is no separate Act though the import of some animal food products is controlled under the provisions of the Prevention of Food Adulteration Act, 1954, applied along with Sea Customs Act, 1878. We have, therefore, suggested, amendments to the Act in paragraph 35.6.1.

Certification

35.7.6 It has been estimated that India's present earnings from the export of livestock and livestock products are hardly 2 per cent of the value of the country's livestock. The chief reason for this low figure is that several infectious diseases of livestock are rampant in India while the world's major importing countries have either successfully eradicated them or have been free from them by virtue of their geographical location. There is, however, a great potentiality of building up a good export trade in livestock and livestock products provided the prospective importing countries can be assured that the livestock and livestock products meant for export are free from risk of infections.

35.7.7 We suggest that enforcement of the quarantine and certification regulations both at the Centre and at the State levels should be entrusted to a central agency. This organisation should form a wing of the Central Bureau of Animal Disease Surveillance and Intelligence in the Division of Animal Husbandry, Union Ministry of Agriculture and Irrigation, as proposed in paragraph 35.8.5. Its staff should consist of one Deputy Commissioner (Animal Quarantine and Certification), one Assistant Commissioner (Import and Quarantine), one Assistant Commissioner (Export and Certification), and Quarantine Officers, one for each of the ports through which import and export of livestock and livestock products are permitted. At present quarantine stations do not exist on borders with Bangladesh, Burma, Bhutan and Nepal. As trade

in livestock and livestock products is bound to increase, we recommend that quarantine stations on Indian borders adjoining these countries should be established.

35.7.8 All the quarantine stations should have adequate facilities for keeping animals under quarantine and for carrying out laboratory examinations. It will also be necessary to accord official recognition to some well-equipped laboratories in India having specialised facilities for undertaking specific tests so that their reports may be legally acceptable.

Pre-export Quarantine

35.7.9 A number of countries have imported livestock and livestock products from India and many more would do so if there was no fear of introducing into their countries the diseases prevalent in India. A sizeable world market for our cattle and buffaloes and various livestock products can be built up provided it can be ensured that the animals meant for export and the areas they come from are free from contagious and infectious diseases and that prior to export the animals were properly quarantined. This can only be achieved if some pre-export quarantine units are set up in well-isolated locations, such as on off-shore islands. There are several such islands where excellent isolation facilities can be created. We, therefore, suggest that two pre-export quarantine stations may be set up during the Fifth Plan, and should the livestock export demands justify, more such stations may be established subsequently.

8 ANIMAL DISEASE INTELLIGENCE SERVICE

35.8.1 A well organised Animal Disease Intelligence Service (ADIS) provides the much needed basic information to lay down scientific norms for the control and eradication of animal diseases. The need for such an organisation is all the greater in a country like India where devastating diseases like foot-and-mouth disease, rinderpest, haemorrhagic septicaemia, anthrax, black-quarter, sheep pox, are still widely prevalent. The ADIS would enable reliable assessment of the incidence and trends of these diseases and the progress made in their control. It would also help in making epidemiological forecasts and in planning vaccination and programmes more rationally and economically.

35.8.2 At present only limited data regarding the prevalence of animal diseases are being collected by the State Veterinary Departments. These can hardly serve as a basis for intelligent interpretation of animal disease trends or for epidemiological forecasts. Under the existing system information on the occurrence of a disease outbreak emanates from a

village revenue official—Patwari or Patil. He sends the report to the Block Veterinarian on a special report card. After receiving this report the Block Veterinarian may visit the village to confirm the disease and to collect appropriate material for sending to a laboratory for examination. The Block Veterinarian sends a monthly report to the District Veterinary Officer, who submits a return in respect of the whole district to the State Director of Veterinary with one copy endorsed to the Livestock Health Branch in the Animal Husbandry Division of the Union Ministry of Agriculture and Irrigation. Information on rinderpest outbreaks is sent immediately by the Block Veterinarian to the District Veterinary Officer/Rinderpest Officer of the State and to the Rinderpest Cell in the Animal Husbandry Division of the Union Ministry of Agriculture and Irrigation, so that the disease may be notified promptly to all the adjoining districts and States. The information contained in these bulletins is rather fragmentary, as it neither indicates trends in the incidence of animal diseases nor does it depict progress made in their control. Further, as the data reported in the bulletin lack support of epidemiological studies, they cannot serve as a basis for scientific disease control programmes.

35.8.3 For building an efficient animal disease intelligence service in the country it is necessary to improve the working of its four major components in the manner proposed below :

(i) Disease reporting unit—Speed and reliability of the primary reporting unit are fundamental to an efficient animal disease intelligence service. Though the basic structure of the existing animal disease reporting system is fairly comprehensive, greater emphasis should be placed on laboratory confirmation of the diagnosis in order to make the primary reporting data more reliable.

(ii) Laboratory unit—At present material for laboratory examination is sent mostly to the State disease investigation laboratories, the veterinary colleges, and the IVRI. It has been observed that the total number of specimens examined annually at the various laboratories is so small that the data regarding the incidence of these diseases cannot be considered sufficiently reliable to feed an efficient animal disease intelligence service. It has been proposed in Section 2 that a clinical disease laboratory should be established in every district. The services of these clinical laboratories should be extensively utilised for confirming the disease outbreaks.

(iii) Epidemiological unit—Epidemiological studies provide the basic data about the character of epidemics of infectious diseases and their trends and give answers to several questions as to how much of a control programme is economically justified, how much is actually needed and how it should be implemented. As such, these are of great

help in the proper planning, execution and evaluation of animal disease control programmes. In view of the great importance of epidemiological studies and of the organisation of animal disease intelligence service, a Division of Epidemiology was established at the IVRI in 1970. It is necessary that the technical know-how that has been built up in this Division should be fully utilised for training a team of veterinarians to work as Epidemiologists in the States and at the Centre. This group would form the core of the ADIS.

(iv) Data Processing and statistical unit—Adequate facilities for training personnel in data processing and statistical work in relation to the requirements of ADIS organisation exist at the Institute of Agricultural Research Statistics (IARS). We suggest that the statisticians to be placed in the animal disease intelligence organisation should be trained at this Institute where short-term courses may also be arranged for professional epidemiologists.

35.8.4 Every State and Union Territory should establish under the Directorate of Veterinary Services an Epidemiological Cell manned by veterinarians and statisticians suitably trained in epidemiological work at the IVRI and IARS. A Central Bureau of Animal Diseases Surveillance and Intelligence (CBADSI) should be created in the Animal Husbandry Division of the Union Ministry of Agriculture and Irrigation under the charge of an officer of the rank of Joint Commissioner supported by an adequate number of epidemiologists, statisticians, and other technical staff. In order to speed up this national programme, we suggest that the entire cost of training State veterinarians and statisticians may be borne by the Government of India at least for one Plan period.

35.8.5 The State epidemiologists and statisticians should be on the pay rolls of the States under the administrative control of the State Directors of Veterinary Services. However, they should all form a homogenous group throughout the country under the technical supervision and guidance of the Officer-in-Charge CBADSI, who should be responsible for coordinating all activities in the field of animal diseases intelligence on a country-wide basis. The Animal Quarantine Unit in the Animal Husbandry Division of the Union Ministry of Agriculture and Irrigation, should also be linked with the CBADSI, as the Bureau would be in an ideal position to guide the working of the Quarantine and Certification Unit.

35.8.6 The CBADSI should develop close liaison with the Central Bureau of Health Intelligence, functioning under the Ministry of Health and Family Planning, Government of India. This collaboration will be of mutual advantage as the two Bureaus will have several common problems to deal with, especially in the field of zoonoses.

35.8.7 With the establishment of the organisation proposed above

we expect that all information pertaining to the epidemiology and control of animal diseases, at present compartmentalised among different professional groups, will get consolidated and scientifically analysed and evaluated under one central organisation. The data thus gathered would serve as the basis for planning future animal health programmes. The CBADSI, armed with this information, would be in a position to exercise continuous vigilance over the position of animal diseases prevalent in India. This will also enable the country to supply reliable data to international organisations like the FAO, OIE, WHO which consolidate worldwide statistics in respect of animal diseases and also to countries wishing to import livestock and livestock products from India. In view of the strategic importance of the CBADSI in the execution of animal health programmes we recommend that the Bureau should be set up on top priority basis.

9 VETERINARY PUBLIC HEALTH

35.9.1 Efforts to organise veterinary public health service (VPHS) started only recently. A beginning in this direction may be said to have been made in 1964 with the establishment of a Division of Zoonoses at the National Institute of Communicable Diseases (NICD). This was followed by the institution of a Master's Degree course in VPH at the All-India Institute of Hygiene and Public Health (AIIPH) in 1970 and the establishment of a Division of Veterinary Public Health at the IVRI in 1971. A National Seminar on Zoonoses held at the NICD in 1968 and the WHO Seminar on VPH held at the IVRI in 1970 provided guidelines for developing the veterinary public health organisation. A good foundation for building up a VPHS in the country has thus been laid during the last decade.

35.9.2 According to the WHO, veterinary public health is the field of activity which protects and advances human wellbeing by utilising the combined knowledge and resources of all those concerned with human and animal health and their inter-relationships. However, in India barring a few collaborative programmes between the medical and veterinary research workers for the study of infectious diseases, the two sister professions have been functioning within watertight compartments so that even the basic data regarding most of the zoonoses in India are not available. The position regarding meat and milk inspection is all the more deplorable; except a few organised slaughter houses and milk plants, regular meat and milk inspection on scientific lines is practically non-existent. The great importance of zoonoses in

relation to public health will be evident from the fact that "nearly four-fifths of the human communicable diseases and parasites are shared with animals"¹. As such, the urgency for building up an efficient veterinary public health organisation in an agricultural country like India where the vast rural masses have their activities closely linked with the animals and even share the same precincts, cannot be over-emphasised. The limited surveys carried out in the country have already shown that zoonotic diseases are responsible for heavy losses. For example, as stated earlier in paragraph 35.5.54, it has been estimated that in the case of rabies alone as many as 15,000 human lives, mostly in the productive age group of 10-45 years, are being lost every year, and that more than 3 lakh people have to undergo anti-rabic treatment resulting in a loss of 4.2 million labour days a year apart from the money spent on diagnosis and treatment.

35.9.3 The veterinary public health service should cover activities in the following areas :

- (i) Zoonoses and their control ;
- (ii) Food hygiene to prevent and control food-borne infections, particularly those communicated through consumption of milk, milk products, meat, meat products, fish, shell fish etc.;
- (iii) Collaborative activities between public health and veterinary research laboratories and diagnostic services to carry out surveillance of zoonotic diseases and to study their epidemiology.

35.9.4 For building up an efficient VPHS a proper infrastructure will have to be developed right from the municipal level up to the national level, as no organisation worth the name exists at present at any level. At the municipal level and the district level, the main functions of the VPHS should be to assume overall responsibility for food hygiene, including sanitary control and inspection of slaughter houses, dairies, milk and egg plants, restaurants and food shops. The VPHS personnel at the municipal and district levels should be directly under the administrative control of the District Health Officer/District Medical Officer. At the State level, the VPH Unit should be concerned with the epidemiological investigation and control of outbreaks of zoonoses and food-borne diseases. The VPH official at the State level entrusted with this task should be of the rank of a Deputy Director attached to the State Director of Health Services/Medical Services. At the national level it will be necessary to appoint a well qualified and experienced public health veterinarian as Deputy Director General (VPH) under the Directorate General of Health Services.

¹ Schwabe, C.W. Report of the Committee on Education of the American Public Health Association: Veterinary Public Health Section. 1972. Cited by Abdussalam, M. 1974. Indian v. J.51(1):1-9

This official should be assisted by two Assistant Directors-General, one for dealing with zoonoses and the other for dealing with matters pertaining to food hygiene. These officials should arrange exchange of information between the Ministries of Health and Family Planning and Agriculture and Irrigation on subjects of common interest and should initiate actions to delimit the areas of zoonotic diseases in the country, fix the priority of control of such diseases, and develop methodology and necessary organisation for their control. All units in the States though under the administrative control of the respective Directors of Health/Medical Services, should form a homogeneous team and be under the technical supervision of the Deputy Director General (VPH).

35.9.5 Institution of VPHS will create a cadre of workers trained in the fields of veterinary science and public health. Since most of the zoonotic infections have their reservoirs in vertebrate animals, the VPH organisation will be in an ideal position to carry out surveillance of zoonotic diseases in both man and animal for the study of their epidemiology, to initiate and execute programmes for the protection of human health from the hazards of zoonotic infections, and to act as a liaison body between public health, medical and veterinary services in the country. We, therefore, recommend that the VPHS should be organised on a priority basis in the manner proposed above.

35.9.6 As for trained veterinarians required for manning the supervisory positions in the VPHS, we expect that the training programme already started at the AIIH&PH leading to the award of Master's degree in VPH will meet the needs of the country. Regarding the training of veterinarians required for the VPHS at the municipal and district levels, we suggest that a three months' special training programme for veterinarians in the field of VPH may be instituted, which may run for one month each at the IVRI, the NICD and the AIIH&PH. These trained veterinarians would provide the personnel to man the posts of Inspectors under the Meat Food Products Order, 1973, and for the enforcement of public health regulations in dairies, milk and egg plants, restaurants and food shops etc.

10 SUMMARY OF RECOMMENDATIONS

35.10.1 The following is a summary of the important recommendations made in the text of this chapter.

1. There was one veterinarian for about 26,000 cattle units in the country by the close of the Fourth Plan. This number is considered

inadequate to ensure the health and production of livestock. The ratio of veterinarians to the livestock population should therefore be narrowed down. There should be at least one veterinarian for every 20,000 cattle units by 1980, 10,000 cattle units by 1990 and 5,000 units by 2000 AD.

(Paragraphs 35.2.1 to 35.2.3)

2. All veterinary hospitals/dispensaries should have sufficient stock of medicines, and facilities for undertaking surgical operations and routine laboratory examinations. A mobile veterinary clinic should be provided at every veterinary hospital so that veterinary aid can be carried right to the door of the livestock owner, whenever necessary. Polyclinics should be established at district and State level in order to introduce multi-disciplinary approach in combating animal diseases, reproductive disorders and nutritional imbalances.

(Paragraph 35.2.4)

3. For improving the quality of veterinary service, it is necessary to supplement the funds of the Veterinary Departments. A phased programme of levying a charge for the treatment of livestock should be introduced immediately.

(Paragraph 35.2.5)

4. In some hospitals, there is a great demand for the services of veterinarians to attend to cases at the premises of livestock owners. Two veterinary doctors should be posted in such hospitals so that one goes for out-door duty and the other may be available for attending to the cases in the hospital. Fees for such visits should be charged from the livestock owners. Half of the amount of the fees should go to the veterinarian and the remaining half to the government revenue.

(Paragraph 35.2.6)

5. Prophylactic vaccinations should be charged on a no-profit and no-loss basis from the beginning of 1985. However, the services rendered and the biologicals used under the national programmes of disease control and in the event of natural calamities should continue to be free.

(Paragraph 35.2.7)

6. The Government should give incentives to veterinarians to set up private practice.

(Paragraph 35.2.8)

7. The disease investigation centre at the State level should have adequate laboratory facilities including those for tissue culture. This centre should be manned by specialists in diseases of different species of animals as well as in different related disciplines.

(Paragraph 35.2.10)

8. The State disease investigation centre should be under the

administrative control of the Director of Veterinary Services.

(Paragraph 35.2.11)

9. The departments concerned with disease diagnosis and investigation work in the agricultural universities should be suitably strengthened.

(Paragraph 35.2.11)

10. The disease investigation unit at the IVRI should have experts of a very high calibre capable of rendering specialized service in their respective fields. The IVRI should also undertake the supply of standard antigens, antisera and diagnostic agents for standardization of biologicals and should serve as a repository of important cultures of microorganisms.

(Paragraph 35.2.12)

11. An organization consisting of veterinarians specialized in exotic diseases should be established so that it can be pressed into service as soon as an exotic disease is suspected to have gained entry into the country.

(Paragraph 35.2.14)

12. High priority should be given to the formation of statutory veterinary councils in the States. The Union Ministry of Agriculture and Irrigation should also constitute an Indian Veterinary Council immediately.

(Paragraphs 35.3.1 to 35.3.7)

13. All State biological production centres should be suitably strengthened on a priority basis, so that they may be in a position to meet the full requirements of their respective States, at least in respect of the simple types of biologicals. As regards the more sophisticated products, the State biological production centres which have fairly good laboratory facilities and equipment, should be encouraged to take up their production. These centres should meet the demands of the whole country in respect of these sophisticated biologicals till the remaining States are also able to start their manufacture. The IVRI may concentrate on the development of technical know-how and methodology for the production of new and improved biologicals.

(Paragraphs 35.4.1 and 35.4.2)

14. All the State biological production centres as well as the Division of Biological Products of the IVRI along with the Foot-and-Mouth Disease Vaccine Production Station at Bangalore should be converted into Biological Products Corporations and run on commercial lines.

(Paragraph 35.4.3)

15. The Biological Production Centre, Gauhati, should be developed into a Regional Biological Products Station to meet the demands of

biologicals of the States/Union Territories in the north eastern region.
(Paragraph 35.4.4)

16. An Expert Committee on Biological Products may be constituted by the Government of India to assess the requirements of the State biological production centres in respect of laboratories, equipment, personnel and training.

(Paragraph 35.4.5)

17. An Expert Committee on Standardization of Biologicals should be constituted to revise the Schedule F₁ giving the specifications for the standardization of biological products and bring it up-to-date.

(Paragraph 35.4.6)

18. For enforcing the provisions of the Drugs and Cosmetics Act in respect of veterinary biological products and veterinary drugs, a post of Controller, Veterinary Biological Products and Drugs should be created in each State. At the Centre, a post of Chief Controller Veterinary Biological Products and Drugs should be created in the Department of Agriculture, Union Ministry of Agriculture and Irrigation.

(Paragraph 35.4.7)

19. A Veterinary Biological Products and Drugs Advisory Board should be set up to advise the Government of India on all matters concerning the veterinary biologicals and drugs.

(Paragraph 35.4.7)

20. A National Veterinary Biological Products Quality Control Institute for standardization of veterinary biologicals should be set up under the administrative control of the Department of Agriculture, Union Ministry of Agriculture and Irrigation.

(Paragraph 35.4.8)

21. A final thrust should be made to wipe out rinderpest infection from the few areas in which it is still lingering. For achieving this objective, the following strategy should be followed :

- (i) Morbid material from each and every suspected outbreak of rinderpest should be expeditiously subjected to laboratory examination.
- (ii) The source of each and every outbreak should be scrupulously traced and definite remedial measures taken to ensure that the lapses responsible for the outbreaks do not recur.
- (iii) The number of rinderpest checkpoints on common cattle routes at the international and inter-state borders and the number of vigilance units at inter-state borders should be increased.
- (iv) All cattle and buffaloes going into the forest for grazing should be vaccinated at the forest checkpoints.

(v) The State Veterinary Departments should intensify the follow-up vaccination programmes.

(vi) Stamping out policy should be gradually introduced.

(Paragraphs 35.5.2 to 35.5.8)

22. Rinderpest tissue culture vaccine should be used since it has been found to be safe for all types of cattle, buffaloes, sheep and goats.

(Paragraph 35.5.9)

23. The State Biological Production Centres at Mhow, Lucknow, Hyderabad, Bangalore, Calcutta and Hissar should also take up the manufacture of rinderpest tissue culture vaccine.

(Paragraph 35.5.10)

24. Epidemiological studies with particular reference to the role of carriers or reservoirs in the dissemination of rinderpest infection should be undertaken.

(Paragraph 35.5.11)

25. Studies to determine the duration of immunity conferred by the rinderpest tissue culture vaccine in indigenous, crossbred and exotic cattle as well as in buffaloes, sheep, goats and pigs should be intensified.

(Paragraph 35.5.11)

26. A systematic programme for control of foot-and-mouth disease should be taken up immediately.

(Paragraphs 35.5.12 to 35.5.14)

27. Production of foot-and-mouth disease vaccine should be stepped up and efforts should be made to reduce its cost of production. The State biological production centres should also take up its manufacture.

(Paragraph 35.5.15)

28. Strict quarantine measures should be rigorously enforced to ensure that SAT I, SAT II, SAT III types of foot-and-mouth disease virus or any other new strain do not gain entry into the country.

(Paragraph 35.5.16)

29. Foot-and-mouth disease typing service should be strengthened by opening more centres particularly to cater to the needs of the areas of intensive livestock development.

(Paragraph 35.5.17)

30. IVRI should intensify research on foot-and-mouth disease in pigs and take early steps for production of an efficacious and inexpensive vaccine.

(Paragraph 35.5.18)

31. Research work on foot-and-mouth disease in sheep and goats with particular reference to the study of its epidemiology should be intensified as these species may be playing an important role in

dissemination of the infection.

(Paragraph 35.5.18)

32. A National Advisory Committee on Foot-and-Mouth Disease should be constituted to supervise the control programme and to offer expert technical guidance in its implementation.

(Paragraph 35.5.18)

33. A systematic programme to control tuberculosis and brucellosis among animals with the ultimate objective of their eradication should be taken up immediately on a countrywide basis.

(Paragraphs 35.5.19 to 35.5.29)

34. A Tuberculosis and Brucellosis Eradication Officer should be appointed in each State. At the Centre, a Chief Tuberculosis and Brucellosis Eradication Officer will be needed for coordinating and guiding the programme on a countrywide basis.

(Paragraph 35.5.30)

35. A National Tuberculosis and Brucellosis Eradication Committee should be set up to chalk out a detailed technical programme, to lay down important guidelines for its implementation and to exercise supervision over the progress of the tuberculosis and brucellosis eradication campaign.

(Paragraph 35.5.30)

36. An effective organization to undertake systematic control of mastitis on a countrywide basis should be built up and a well-equipped laboratory for mastitis work should be established in each State.

(Paragraphs 35.5.31 to 35.5.36)

37. A massive audio-visual programme should be launched to educate livestock owners regarding the economic importance of control of mastitis in dairy animals.

(Paragraph 35.5.35)

38. Epidemiological maps indicating the endemic areas of haemorrhagic septicaemia, anthrax and black-quarter should be prepared by the State Veterinary Departments and a more systematic vaccination programme should be taken up in the endemic areas.

(Paragraphs 35.5.37 to 35.5.39)

39. Contagious bovine pleuro-pneumonia which is confined only to a few districts in Assam should be eradicated as quickly as possible by stamping out policy.

(Paragraphs 35.5.40 and 35.5.41)

40. A Committee of Animal Disease Specialists should be constituted immediately to carry out a thorough on-the-spot study of the factors responsible for the increase in mortality due to contagious bovine pleuro-pneumonia during recent years.

(Paragraph 35.5.42)

41. A systematic programme for control of fascioliasis (liver fluke

disease) in cattle should be launched. It will be necessary to appoint a Liver Fluke Control Officer in each State where the disease is a serious problem.

(Paragraphs 35.5.43 to 35.5.48)

42. Research work on fascioliasis particularly on ecological behaviour of the intermediate host and the effect of different molluscicides on the snails and the environment should be intensified. The drugs that are being marketed for treating fascioliasis in domestic animals should be subjected to carefully controlled trials to pick up the most effective and safe drug for field application.

(Paragraph 35.5.49)

43. The State Animal Husbandry Departments should give priority to duck raising programme in the fluke-infested areas as a step towards the biological control of snails.

(Paragraph 35.5.49)

44. In view of the serious loss suffered by the animal industry due to warble fly infestation, a systematic programme for its control should be taken up at an early date.

(Paragraphs 35.5.50 and 35.5.51)

45. Research work on theileriasis with particular reference to the study of the antigenic make-up of the local theileria strains and for development of an efficacious prophylactic vaccine should be intensified. Research work should also be undertaken to develop simple serological tests which could easily be applied in the field for detection of early and latent cases. The relative efficacy of various compounds put up recently in the market by some pharmaceutical firms for treatment of theileriasis should be tested under carefully controlled conditions in research institutes and agricultural universities for selection of the most suitable drug.

(Paragraph 35.5.52)

46. Large scale production of inactivated sheep pox virus vaccine, according to the Russian method, should be undertaken immediately at all the biological production centres. This vaccine should be used for prophylactic immunization of sheep till such time a better vaccine is available. Research work at IVRI and at other suitable centres should be intensified for developing a more efficacious vaccine.

(Paragraph 35.5.53)

47. Effective measures for control of rabies should be immediately undertaken. The programme should be launched during the Fifth Five Year Plan in the capital of each of the States/Union Territories and it should be gradually extended to other cities and towns till the whole country is covered.

(Paragraphs 35.5.54 to 35.5.56)

48. Should an outbreak of swine fever occur in future in any other State than Meghalaya and Nagaland, stamping-out policy should be followed. In case of Meghalaya and Nagaland, if the disease still persists and if the foci of infection spread, prophylactic mass vaccination programme should be undertaken without any delay.

(Paragraphs 35.5.57 and 35.5.58)

49. Free movement of pigs from Meghalaya and Nagaland to other parts of the country should not be allowed till these States are absolutely clean of swine fever infection.

(Paragraph 35.5.59)

50. In order to meet any future emergency, it should be ensured that adequate quantities of lapinised swine fever vaccine are stored all the year round at Izatnagar, Hissar, Ranipet, and Calcutta where the vaccine is being manufactured at present. The Biological Products Station at Gauhati should also undertake the production and storage of this vaccine, since extensive pig development work has been taken up in the north eastern region of the country.

(Paragraph 35.5.60)

51. As swine fever is almost wholly under control, quarantine regulations should be rigidly followed in the case of all pigs imported from abroad.

(Paragraph 35.5.61)

52. Studies should be undertaken to investigate if wild pigs or some other non-swine reservoirs of this infection exist so that appropriate action may be taken for the elimination of the swine fever virus and for checking its spread to domestic pigs.

(Paragraph 35.5.61)

53. For bringing down the incidence of Ranikhet disease to an insignificant level it is necessary to raise the target of vaccination to cover at least 80 per cent of the poultry population within a couple of years and to maintain this level of vaccination target for a period of about 10 years. At that stage, it would be worthwhile to start a pilot project in some selected areas, where vaccinations may be stopped and reliance placed on hygienic and sanitary measures for keeping the poultry farms free of the disease. Should an outbreak occur in such an area, stamping out policy should be followed. If this approach proves successful, the programme should be gradually extended to bring more and more poultry farms in contiguous areas under its orbit till the whole country is covered.

(Paragraphs 35.5.62 to 35.5.65)

54. A national programme for control of Marek's disease with the ultimate objective of its eradication should be initiated immediately.

(Paragraphs 35.5.66 to 35.5.68)

55. Since Marek's disease vaccine is not being produced at present anywhere in India it should be imported from abroad till it can be manufactured indigenously. Only turkey herpes virus vaccine should be imported till a better vaccine is available.

(Paragraph 35.5.69)

56. Complete records pertaining to mortality and productive performance of the vaccinated birds should be maintained at farms where vaccination is resorted to. These data should be carefully analysed by a Committee of Experts which should be appointed by the Government of India, for finding out the effectiveness of vaccination as a method for control of Marek's disease.

(Paragraph 35.5.70)

57. To conserve foreign exchange, manufacture of turkey herpes virus vaccine should be taken up on priority basis by IVRI and other biological production centres.

(Paragraph 35.5.71)

58. Research work on Marek's disease with particular reference to its epizootiology and factors relating to virus shedding, viability of the virus under field conditions and development of a more effective vaccine should be intensified at IVRI and some agricultural universities.

(Paragraph 35.5.72)

59. A systematic programme for control of chronic respiratory disease (avian respiratory mycoplasmosis) should be taken up at a very early date.

(Paragraphs 35.5.73 to 35.5.75)

60. Production of the antigen for serological diagnosis of chronic respiratory disease should be taken up by some more biological production centres so that the antigen is available in adequate quantity for the national programme for control of the disease.

(Paragraph 35.5.74)

61. A National Pullorum Eradication Campaign should be launched immediately with a target to complete the work before the close of 1980.

(Paragraphs 35.5.76 to 35.5.78)

62. A suitable vaccine strain against duck virus hepatitis should be imported from abroad and vaccine as well as hyperimmune serum against this disease should be produced in the country.

(Paragraphs 35.5.79 and 35.5.80)

63. Vast majority of animals in India manifest sub-clinical syndromes of deficiency diseases in a complex form resulting from an overall low intake of nutritional substances. In order to save the live-stock from further degeneration, production of animal feeds and

fodders should be augmented and the number of unproductive and uneconomic stock should be reduced.

(Paragraphs 35.5.81 and 35.5.82)

64. Systematic control of diseases like Johne's disease, enterotoxaemia, babesiosis, anaplasmosis, schistosomiasis, amphistomiasis, coccidiosis, lungworm infestation, contagious caprine pleuro-pneumonia, fowl pox, fowl sprochaetosis, fowl typhoid etc. should be undertaken.

(Paragraph 35.5.83)

65. Programmes for the systematic control and eradication of foot-and-mouth disease, tuberculosis, brucellosis, contagious bovine pleuropneumonia, pullorum disease and Marek's disease should be financed wholly or partly by the Government of India. As for the remaining diseases discussed in Section 5 of this Chapter, it should be the responsibility of the State Veterinary Departments to intensify measures for their systematic control.

(Paragraphs 35.5.84 and 35.5.85)

66. The Joint Commissioner (Livestock Health) in the Animal Husbandry Division, Union Ministry of Agriculture and Irrigation should analyse periodically the trends in the incidence of the diseases and the progress achieved in their control on a countrywide basis and keep the States informed.

(Paragraph 35.5.86)

67. The Livestock Importation Act should be suitably modified, so that the authority to implement this Act vests with the Government of India and not with the State Governments. Regulations should also be added to control import of cultures of microorganisms, semen and veterinary biologicals and to enforce laboratory examination of imported livestock products like eggs, meat, cheese, butter etc. Animals to be imported for zoological gardens should also be brought under the provisions of this Act.

(Paragraph 35.6.1)

68. Suitable legislation should be enacted on a priority basis to regulate the inter-state movement of livestock to prevent the spread of diseases from one State to another.

(Paragraph 35.6.2)

69. Enforcement of the quarantine and certification regulations should also be entrusted to the quarantine organisation in the Animal Husbandry Division of the Union Ministry of Agriculture and Irrigation, which should be suitably strengthened.

(Paragraphs 35.7.1 to 35.7.7)

70. Quarantine stations should also be established on Indian borders adjoining Bangladesh, Burma, Bhutan and Nepal.

(Paragraph 35.7.7)

71. All quarantine stations should have adequate facilities for keeping animals under quarantine and for carrying out laboratory examinations.

(Paragraph 35.7.8)

72. Official recognition should be accorded to some well-equipped laboratories in India having specialised facilities for undertaking specific tests so that their reports may be legally acceptable.

(Paragraph 35.7.8)

73. Two pre-export quarantine stations may be built up during the Fifth Plan in well isolated locations, such as on off-shore islands. Should the livestock export demands justify, more such stations may be established subsequently.

(Paragraph 35.7.9)

74. A Central Bureau of Animal Disease Surveillance and Intelligence should be set up on priority basis in the Animal Husbandry Division of the Union Ministry of Agriculture and Irrigation. Every State and Union Territory should establish under the Directorate of Veterinary Services an Epidemiological Cell.

(Paragraphs 35.8.1 to 35.8.7)

75. There is a great urgency for setting up a Veterinary Public Health Service in the country. As no organization worth the name exists at present at any level, a proper infrastructure should be developed right from the municipal level up to the national level.

(Paragraphs 35.9.1 to 35.9.4)

76. For the training of staff for the Veterinary Public Health Services at the municipal and the district levels, a three months' training programme for veterinarians may be instituted.

(Paragraph 35.9.6)

MEAT PRODUCTION AND ANIMAL BYPRODUCTS

Meat industry in India has great economic potentialities but so far it has received very little attention. The quantity of meat produced is far below the requirements and suitable meat breeds of livestock have not yet been developed. The hygienic conditions in most of the slaughter houses are appalling and animal byproducts of substantial value are wasted. In this Chapter the present status of meat production and utilisation of animal byproducts is discussed, and measures suggested for building up meat industry on sound and scientific lines.

1 MEAT PRODUCTION

Production and Demand for Meat

36.1.1 At present about 720 thousand tonnes meat are being produced annually in the country. About 54 per cent of the meat is from sheep and goats, 26 per cent from buffaloes and cattle, 13 per cent from poultry and 7 per cent from pigs. The quantity of meat produced during the years 1961 to 1974 is given in Table 36.1.

TABLE 36.1

Meat Production in India¹

('000 tonnes)

	1961-65	1968	1969	1970	1971	1972	1973	1974
beef and buffalo meat	165	169	170	176	179	182	186	187
mutton and goat meat	353	356	356	366	371	377	384	385
pig meat	43	51	52	52	52	52	53	54
poultry meat	70	69	69	83	86	90	95	95*
total	631	645	647	677	688	701	718	721

1 (i) FAO Production Year Book, 1971, 1972 and 1973.

(ii) FAO—Monthly Bulletin of Agricultural Economics and Statistics, December, 1974.

* Estimate for 1973 has been repeated.

It will be seen from Table 36.1 that the increase in meat production in 1973 over the average production during 1961 to 1965 was about 14 per cent. Against this, the demand for meat is expected to increase rapidly in the years to come. We have estimated the likely levels of demand for meat in 1985 and by the turn of the century in Chapter 10 on Demand Projections on the basis of the possible levels of income growth and growth of population. According to this projection, the aggregate consumer demand for meat will range between 1.1 and 1.4 million tonnes in 1985 and between 1.6 and 2.1 million tonnes in 2000 A.D. against 0.72 million tonnes in 1971. The annual per capita consumption of meat is projected to increase from 1.25 kg in 1971 to between 1.45 and 1.93 kg in 1985 and between 1.68 and 2.26 kg in 2000 A.D. According to the Indian Council of Medical Research, balanced diet for a meat eating adult should include 30 g of meat and fish per day. On this basis, the per capita requirement of meat and fish for a balanced diet works out to 24 g per day. Assuming that about 30 per cent of this is accounted for by meat, the per capita requirement of meat on nutritional standards works out to 2.55 kg/annum for the meat-eating population estimated at 70 per cent of the total population. This works out to 1.79 kg per annum for the entire population. Urgent steps have, therefore, to be taken to enhance considerably the production of wholesome meat for human consumption. Sheep, goat, pig and buffalo development programmes with particular reference to the improvement of their meat qualities should, therefore, be intensified as outlined in Chapters 30, 32 and 28 respectively. The programmes for augmentation of production of fish and poultry meat have been discussed in Chapters 36 and 37 on Marine and Inland Fisheries and Aquaculture and Chapter 31 on Poultry.

36.1.2 About 37.3 million sheep and goats, 1.5 million pigs and 1.4 million cattle and buffaloes are being slaughtered annually in the organised slaughter houses. Meat of freshly dead cattle and buffaloes is also consumed by the poor section of some communities. This practice is, however, fast disappearing. Table 36.2 gives the percentage of the animals slaughtered annually in relation to their respective population.¹

TABLE 36.2

Percentages of Animals Slaughtered

Type of animal	Percentage Slaughtered
cattle	0.9
buffaloes	1.4

Chatterjee, A. K. Project Report, 1970, Central Food Technological Research Institute Mysore.

Type of Animal	Percentage Slaughtered
sheep	32.5
goat	36.8
pigs	22.0
others	6.4

The percentage of cattle and buffaloes slaughtered in India in relation to their population is exceedingly small, viz., 0.9 and 1.4 per cent respectively. Against that the percentage of cattle slaughtered in the developed countries is between 30 and 40 per cent as will be evident from Table 36.3.

TABLE 36.3

Percentages of Cattle Slaughtered in some Developed Countries (1969)¹

Country	Number of cattle slaughtered (thousands)	Cattle population (thousands)	Percentage of slaughtered cattle
USA	40,585	112,330	36.13
UK	3,798	12,697	29.91
Denmark	1,157	2,835	40.81
Australia	7,213	20,700	34.84
New Zealand	3,051*	8,839	34.52

*Relates to 1968.

The demand for beef and buffalo meat for domestic consumption is not likely to rise to any great extent till the year 2000 A.D. However, there is considerable scope for building up an export market for buffalo meat especially to the countries in the Middle East. At present, only 15-20 tonnes of buffalo meat are being exported per day. We are of the opinion that urgent steps should be taken to improve meat characteristics of the buffalo. Further, unwanted male buffalo calves, which at present are allowed to die prematurely, should be fattened quickly by giving them cheap feeds with supplements of molasses and urea. Meat from such animals will find a good foreign market. Unproductive buffaloes which are surplus should also be slaughtered and their meat would be available for export. The poor condition of such animals will not hinder export as there is great demand for 'lean meat' for soup manufacture.

36.1.3 One of the major hurdles in the production of wholesome meat under hygienic conditions is the primitive condition of slaughter houses. There are nearly 2,800 slaughter houses in the country

¹ FAO Production Year Book 1970.

operating under the local bodies but, excepting a few many of them lack even elementary facilities for hygienic production and handling of meat and for collection and utilisation of animal byproducts. According to a survey¹ carried out in 1952, none of the existing slaughter houses in India was in a position to produce meat conforming to the standards required for export to developed countries. The position since then has not changed much and most slaughter houses continue to function under the same unsatisfactory conditions. In order to create conditions conducive for the production of wholesome meat under hygienic conditions, a scheme for modernisation of slaughter houses was taken up during the Third Five Year Plan with an outlay of Rs. 303 Lakhs with 100 per cent loan as Central assistance. However, due to non-availability of technical know-how and also due to socio-political hindrances, the State Governments could not take up the projects during the Third Plan.

36.1.4 Realising the importance of the scheme for modernisation of slaughter houses and also export potentialities of meat and meat products, the National Development Council recommended in the year 1968 that slaughter houses should be set up as commercial corporations and the Government of India should subscribe towards their equity capital. Accordingly, schemes for the improvement and construction of 14 slaughter houses were prepared and included in the Fourth Plan. However, the progress was disappointing. One of the major hurdles was to bring on the common platform of a commercial corporation the Government of India, the concerned State Government and local municipalities backed by institutional finance. The State Governments and local municipalities wanted grants, not equity capital from the Government of India. Besides, most of the municipal slaughter houses were too small to function as commercial corporations. However, five corporations, viz., (a) Goa Meat Complex; (b) Animal Food Corporation (P) Ltd., Bangalore; (c) Hyderabad Meat Production Cooperative; (d) West Bengal Livestock Processing Corporation and (e) Tamil Nadu Meat Industries Corporation have recently been formed to implement the programme of modernisation of slaughter houses. A modern abattoir in Deonar, Bombay has been established by the Greater Bombay Municipal Corporation with an investment of nearly Rs. 4.25 crores. About 7000 sheep and goats, 500 to 600 bullocks and buffaloes and 200 pigs are being slaughtered daily in this abattoir. Initially there was a lot of opposition from the butchers. But by overcoming these and other difficulties the Deonar abattoir is now operating to its full capacity and there is pressure on the management to expand its capacity. Ministry of Defence has also

¹ Thoroton, H. WHO/FAO Food Hygiene Consultant, 1952. A Survey of food hygiene practices in India.

constructed a modern plant in Hazaratpur near Tundla (Agra) which handles about 1500 sheep and goats per day for the production of freeze dried meat for the army.

Impediments to Modernisation

36.1.5 Socio-economic factors, particularly unfounded fear regarding municipalisation of the trade by the meat corporation or by the Government, create an undercurrent of resistance among the intermediary operators and the rich butchers who enjoy almost a monopoly of the trade. These pressure groups, for their own vested interests, hinder any attempt to modernise slaughter houses. Further, techno-feasibility reports for setting up modern slaughter houses indicate relatively small returns in the first ten years due to high capital costs. The State Finance Departments give preference to other industries with short term higher returns rather than develop a major source of clean wholesome food, which at the same time saves so much waste of useful byproducts. The non-availability of suitable stockyards and livestock markets in the vicinity of the slaughter houses constitutes another serious difficulty. Under the prevailing conditions the primary producers of meat animals cannot bring their livestock through cooperative trade channels nor can they sell them directly to the retail butchers. The business is a monopoly in the hands of a few rich butchers and middlemen who take away the cream of the profit. The primary producers of meat animals get insufficient incentive. Under proper management, a modern slaughter house can help break this vicious circle and ensure itself increasing supply of quality meat.

36.1.6 The necessary expertise and competence to undertake modernisation of slaughter houses has been gradually built up. According to a recent study¹ made by the Council of Scientific and Industrial Research, at least 80 per cent of the abattoir equipment can be designed and fabricated indigenously. Further, some Indian firms dealing with slaughter house design, erection and consultancy work have come up. Training facilities in meat science and technology and in the setting up of animal byproducts processing plants have also been developed in the country. Thus the required technical inputs for taking up large programmes of modernisation of slaughter houses are now available.

36.1.7 We feel that before undertaking any major project for a meat complex, a pre-investment survey should be done. In this context, we have examined the question of suggesting detailed guidelines to prepare techno-feasibility report for initiating a modern meat complex.

¹ Report of the Task Force on Abattoirs and Animal Byproducts, 1973 Council of Scientific and Industrial Research, New Delhi.

A number of variables may come up while formulating the cost estimates depending upon the topography of the land, availability of raw materials, retail and wholesale distribution of the produce, availability of transport, water, electricity and sewage disposal facilities, proximity of railway station etc. Based on the cost estimates given in the report of the Task Force on Abattoir and Animal Products (1973)¹, estimates of economic feasibility for setting up three different sizes of modern abattoirs have been prepared. The details are given in Appendix 36.1.

Processed Meat

36.1.8 The total production of processed meat in India per year was only of the order of 325 tonnes till 1960-61. Thereafter, there was a steady increase in its production, which went up to 5,000 tonnes by 1968 and reached 10,000 tonnes (projected estimate) by the end of the Fourth Plan. Processed meat products mainly consist of pork, ham, bacon and sausages. Eight bacon factories under public sector are operating in the different regions of the country and are producing nearly 1,000 tonnes of meat and meat products, out of which more than 80 per cent is pork. Eight more bacon factories are proposed to be set up during the Fifth Plan. Location of the modern bacon factories under public sector, their installed capacities and production level are given in Appendix 36.2. Looking at the overall installed capacity of the bacon factories and the meat processing units, we are of the opinion that these along with the eight more bacon factories proposed to be set up during the Fifth Plan can meet the needs of the whole country for a considerable time.

Problems of Marketing

36.1.9 The marketing of meat covers all the activities involved from the point the producers sell meat animals to the first buyer and extends up to the stage when meat and other byproducts reach the consumers. Under the prevailing conditions in India, the marketing of meat involves several agencies, intermediate operators or groups of them and it is difficult to assess how many hands it has to change before it reaches the table. There is an imperative need to modernise the livestock market practices in relation to the meat trade. At present, various functions such as assembly of animals, slaughter, processing,

¹ Report of the Task Force on Abattoirs and Animal Byproducts, 1973 Council of Scientific and Industrial Research, New Delhi.

storage, transportation and merchandising are performed by groups of individuals, each taking a very high margin of profit for services rendered. This will be evident from the study of the functioning of Bombay livestock markets (Appendix 36.3) carried out recently by the General Manager, Deonar Abattoir. We are of the opinion that it is imperative to establish an organised marketing service for meat animals in the cooperative sector at least in cities and big towns. The livestock markets should be operated as terminal markets owned by the State Governments or cooperatives and should provide facilities for yarding, feeding and watering of meat animals. Veterinary services and banking facilities should be provided at these markets. At present, no such organised market is working in India.

36.1.10 A study of the meat marketing system in the country has revealed that although the retail prices of meat have gone up considerably, proportionate benefit has not reached the primary producers so as to encourage more meat production. Economic pressures and lack of information about the prices realised by the middlemen and the intermediate operators, force the producers to sell the animals at a relatively cheaper rate as is seen from the study reproduced in Appendix 36.3. Thus the interest of the producers gets sadly neglected, the middlemen and the intermediaries enjoy at the cost of the primary producers of meat animals. In view of this, we are of the opinion that a positive price policy should be evolved which ensures a fair price to the primary producers and under which the consumers get good quality meat and meat products at a reasonable price. Since the problem of marketing of meat is a complex one, studies should be undertaken immediately by the Directorate of Marketing and Inspection, Government of India and State Marketing Organisations to work out how best this can be achieved.

Export Trade of Meat

36.1.11 Meat is a highly export oriented item. The value of meat and meat products exported during 1969-70 to 1973-74 are given in Table 36.4

TABLE 36.4
Export of Meat and Meat Products

Year	Value (Rs. lakhs)
1969-70	144
1970-71	305
1971-72	138
1972-73	347
1973-74	684

It will be observed from the above table that export of meat is increasing year after year. The value of the exported meat and meat products which was only about Rs. 144 lakhs in 1969-70 has risen to Rs. 684 lakhs in 1973-74. This represents more than four times increase within 5 years. There is great scope for further rapid expansion.

36.1.12 The increase in the export of meat during the last three years has been mainly due to the functioning of the modern abattoir complex in Deonar, and high price of meat in the international market. We have been informed that gross under-invoicing is going on in the export trade of meat from Bombay and that the export figures would have indicated much higher returns had all the exported meat been channelised through an organised agency like the State Trading Corporation (STC). The export of chilled or frozen mutton has resulted in further shortage of meat for domestic consumption. As such a tendency is developing amongst the butchers to slaughter immature sheep and goats to cater to the local demand. This is bound to further aggravate the present shortage. We, therefore, recommend that the export of meat and meat products should be brought under the control of some organised agency like the STC and the quality control should be entrusted to the Directorate of Marketing and Inspection.

Improvement of Meat Industry

36.1.13 The meat industry in India is operating at present at a low level of efficiency. One of the basic reasons for its poor performance is that the yield from the indigenous meat animals is very low. Exotic inheritance for improving the mutton and pork qualities of the Indian breeds of sheep and pig has, therefore, been introduced recently. This programme should be intensified. Further, with a view to formulating a national policy for expansion and modernisation of the meat industry and to advise the Government on connected problems, a Slaughter House Advisory Committee should be constituted under the Union Ministry of Agriculture and Irrigation. There is also an urgent need to strengthen the existing Slaughter House Unit in the Animal Husbandry division of the Union Ministry of Agriculture and Irrigation so that it could provide necessary leadership and technical knowhow for setting up modern slaughter houses.

36.1.14 Funds set apart for the modernisation of abattoirs both in the Central and in the State sectors are getting only nominally utilised. After studying the reasons for the under-utilisation of these funds, we feel that there is need for a change in the pattern of financial assistance for implementing the programme of modernisation of slaughter houses.

As already stated in paragraph 36.1.5, the techno-feasibility report of a modern slaughter house complex indicates relatively small returns in the first ten years due to high capital costs. The State Governments, therefore, give preference to other industries which yield higher returns. Modernisation of slaughter houses is essentially required for production of wholesome meat under hygienic conditions and to salvage animal byproducts. We recommend that in the initial stages setting up a modern slaughter house should be regarded as a development activity and not as a commercial venture. In order to provide incentive to the State Governments, the Central Government may give about 50 per cent assistance as direct grant for establishing one modern slaughter house complex in each State during the Fifth Plan. It is equally important to provide essential amenities and improve the hygienic conditions in the existing slaughter houses. The State Governments should provide sufficient funds for this purpose on a priority basis.

36.1.15 In order to improve the meat trade, a Meat Food Products Order was promulgated in 1973. This Order covers only processed meat. We recommend that the scope of this Order should be enlarged to cover unprocessed meat as well. Further, the specifications laid down by the Indian Standards Institution for different types of meat and meat products should be rigidly followed so that the consumers are assured of the quality. For enforcing the provisions of the Meat Food Products Order, a proper technical infrastructure should be built up immediately as proposed in the Section on Veterinary Public Health in Chapter 35 on Animal Health.

36.1.16 There is an imperative need to impart in-plant training to technicians required to work in the modern slaughter houses. Such training courses should be arranged periodically by the Division of Animal Husbandry of the Union Ministry of Agriculture and Irrigation at the Deonar Abattoir, the Central Food and Technological Research Institute (CFTRI) and at the Indian Veterinary Research Institute (IVRI). Research work on problems connected with production, processing and storage of meat and meat products should be intensified at the CFTRI, IVRI and at some of the agricultural universities having facilities for this type of study.

2 ANIMAL BYPRODUCTS AND ANIMAL WASTES

36.2.1 Utilisation of animal byproducts and animal wastes is extremely vital. This aspect has not yet received due attention in India.

6 A&I/76—35

There is thus a colossal loss on this score. As already stated in paragraph 36.1.3, the slaughter houses in the country barring a couple of those established recently, are functioning under most primitive conditions. These lack even ordinary facilities for the timely collection of byproducts from slaughtered stock. Further, epidemics of deadly diseases, vast number of animals living and dying in scattered areas, extremes of heat, heavy rains and floods dislocating communications, inaccessibility of many places due to difficult terrain, are some of the important factors standing in the way of efficient collection of byproducts from fallen animals. In the following paragraphs, the huge wastage resulting from extremely poor utilisation of animal byproducts is discussed and suggestions given to salvage these products. We feel that with the development of transport facilities, gradual disappearance of sentiments against handling of carcasses of cattle and better organisation of collection agencies, the utilisation of animal byproducts and wastes will certainly improve. The rise in the economic return of animal byproducts will further strengthen this programme.

Hides and Skins

36.2.2 The estimated annual production of hides in the world is of the order of 6 million tonnes, out of which the share of India is 12 per cent. India stands second in the world in the field of hide production sharing that position with the USSR. The USA stands first accounting for 17.5 per cent of the world production. The estimated annual production of skins in the world is of the order of 1.3 million tonnes, out of which India accounts for 7.4 per cent and ranks fifth. The annual production of hides in India during 1972 was estimated to be 24,501,000 pieces and of goat and sheep skins 49,415,000 pieces.¹

36.2.3 Due to restrictions on the slaughter of cattle more than 90 per cent of hides are obtained from fallen stock. Hides of all animals which die cannot be fully claimed as arrangements for timely flaying of dead animals are not available in many parts of the country. Loss of hides of animals lost in floods, famines and those dying in remote areas has been estimated to range between 4 and 10 per cent in different parts of the country.² In the case of skins, the wastage due to non-collection is negligible, the major proportion of skins being recovered from slaughtered stock. The estimated annual loss of skins due to non-collection from dead stock has been reckoned at 1 to 2 per cent.³

36.2.4 Data on exports and imports of hides, skins and fur skins

1, 2, 3 Directorate of Marketing and Inspection, Government of India.

(undressed) for the years 1961-62 to 1973-74 are given in Appendices 12.1 and 12.6 respectively of Chapter 12 on Export Possibilities and Import Substitution. It would be seen from the data that during the decade ending 1970-71 peak exports were reached in 1966-67 (Rs. 16.47 crores) and the highest imports were recorded in 1963-64 (Rs. 3.36 crores). Table 36.5 gives the value of foreign trade in recent years.

TABLE 36.5

Value of Exports and Imports of Hides, Skins and
Fur Skins (undressed)

Year	(Rs. lakhs)	
	Exports	Imports
1970-71	379	158
1971-72	66	135
1972-73	87	102
1973-74	153	77

It would be seen from the above table that both exports and imports have evinced a declining trend. Exports had declined to as low as Rs. 66 lakhs in 1971-72 though subsequently there was some recovery with exports in 1973-74 being Rs. 153 lakhs. Imports have, on the other hand, been steadily declining over the years, the order of imports in 1973-74 being Rs. 77 lakhs. It might be mentioned that the decline in exports was largely due to government's restrictive export policy in respect of this item. However, in view of the large bovine population there is considerable scope for increasing export of hides through timely collection and improvement of their quality. In a highly competitive and quality conscious world market, mere number may not be of much avail. Though India stands second in the world in the production of hides and fifth in the matter of production of skins, it cannot forge ahead in capitalising on its large production unless stress is laid on quality right from the initial stages of production. As such, improved methods of flaying should be introduced in the slaughter houses and better flaying should be encouraged by payment of premia to good flayers. The All India Khadi and Village Industries Commission has set up a number of flaying centres in the rural areas through the State Khadi and Village Industries Boards. There is however an urgent need for establishing more village flaying centres for skilled flaying of fallen animals. Demonstration-cum-training centres should be established in important places for imparting training in curing, tanning and rational utilisation of hides. The Directorate of Marketing and Inspection should be suitably strengthened

to carry out grading of hides and skins according to Agmark standards. Cold storage facilities for preserving raw hides and skins may also be provided, wherever possible. Before export, a system of compulsory preshipment inspection should be introduced. This measure is of vital importance in securing quality.

36.2.5 As against the declining trend in the exports of hides and skins, leather and leather manufactures have been emerging in a significant manner in Indian exports. The average annual exports of this item improved from Rs. 63 crores during the triennium ending 1968-69 to Rs. 146 crores during the triennium ending 1973-74 with the peak having been reached in 1972-73 when exports amounted to Rs. 175 crores.

36.2.6 The estimated annual production of guts from slaughtered cattle, buffaloes, sheep, goats and pigs is given in Table 36.6.

TABLE 36.6
Estimated Annual Production of Animal Guts from
Slaughtered Stock (1967-68)¹

Species	(in tonnes)		
	Small Intestines	Large intestines	Total
cattle	1516.9	950.7	2467.6
buffaloes	2147.3	1412.3	3559.6
sheep and goats	23728.1	15886.0	39614.1
pigs	1875.2	881.5	2756.7
total	29267.5	19130.5	48398.0

There is a great demand in foreign countries for the casings produced in India. During 1969-70, casings worth Rs. 231.00 lakhs were exported. Since then export declined sharply. In 1970-71 and 1971-72 casings worth only Rs. 120.00 lakhs and Rs. 96.00 lakhs respectively were exported. In 1972-73 there was a further fall still and the value of the exported casings dropped to Rs. 88.00 lakhs.

36.2.7 For effecting an improvement in quality and to increase the quantity of casings collected for processing, the first essential step is improvement in the conditions prevailing in the slaughter houses. Modernisation of slaughter houses and provision of a byproduct wing in them are absolutely essential. However, pending modernisation an interim measure to improve the quality of the casings immediately would be to make provision for adequate water supply in the existing slaughter houses so that the guts are cleaned properly within the pre-

¹ Directorate of Marketing and Inspection, Government of India.

cincts, and with the least possible delay. At present, some countries like the UK, the USA have banned the import of Indian animal casings, as according to them the hygienic conditions in the Indian slaughter houses do not meet even the minimum requirements prescribed by these countries. The Government of India has passed Meat Food Products Control Order, 1973. It is essential to enforce this Order strictly, which would ensure hygienic production of meat and meat byproducts. In many slaughter houses, guts are not removed soon after the slaughter of animals. This results in deterioration of the quality of guts. As such, it should be made obligatory on butchers to remove guts within prescribed hours. The byproducts wing of each slaughter house should have a processing unit for guts under hygienic conditions. Guts may then be sorted out according to calibre, grade etc. thus making it easy for the exporter as well as the processor to do only the final grading. This would fetch a better price for the graded product.

Bones

36.2.8 According to an estimate made by the Directorate of Marketing and Inspection, annual production of bones in India in 1967-68 was of the order of 426,000 tonnes and the collection is only about 40 per cent of the estimated availability. For increasing collection of raw bones, the formation of cooperatives of bone collectors should be encouraged, and bone purchasing depots should be established in blocks. Further, flaying of carcasses should be allowed only at the flaying centres.

36.2.9 A major portion of the bones collected in India is utilised for production of crushed bones and bone grists and a small quantity is used for the manufacture of bonemeal. There were 100 bone crushing mills and about 360 bone digestors in the country at the end of the Fourth Plan. Most of the mills crush bones primarily with the object of exporting crushed bones and bone grists. The bone digestors are working on a cottage industry basis set up in various States with the aid of the Khadi and Village Industries Commission or the State Governments for converting locally available raw bones into bonemeal for utilisation as fertiliser. New bone digestors will have optimum use if set up only in areas capable of utilising the bonemeal, preferably in remote places unconnected by rail or road. Cooperatives of bone collectors should be provided with bone digestors on rent. Encouragement should be given by the State Governments for setting up factories for the manufacture of gelatine, glue

and Neat's foot oil.

Animal Fats

36.2.10 There is considerable wastage of animal fats in India due to non-collection or delayed collection. Full and rational utilisation of animal fats which are available in large quantities from fallen and slaughtered animals is highly important. This would not only benefit the livestock producers but would also help in saving foreign exchange worth crores of rupees, which are being spent at present on the import of animal fats. As large a quantity as 61 million kg. of animal fats valued at Rs. 8.9 crores are being imported in a year (1972-73).¹ We suggest that all big slaughter houses which are being modernised should have a byproduct plant within their precincts or in close proximity so that all available fats from slaughtered stock could be processed. Efforts should also be made for efficient and quick recovery of fats from the dead animals. Since the proportion of fallen stock is very much higher in the case of bovines, a chain of carcass utilisation centres should be established in areas of concentrated bovine population.

Bristles

36.2.11 India is one of the few countries which produce bristles of very high quality. Indian bristles are mostly obtained from the indigenous domesticated pigs. Small quantities of bristles are also obtained from the wild and semi-wild boars. The annual production of bristles based on the Livestock Census of 1966 has been estimated by the Directorate of Marketing and Inspection to be of the order of 3,40,000 kg. During the years 1972-73, bristles weighing 1,41,672 kg. valued at about Rs. 1,37,000 were exported.¹ There is need to educate the pig rearers and the bristles merchants regarding the economic importance of bristles, particularly as an earner of foreign exchange so that more bristles are collected and dressed for export. The Indian brush industry deserves encouragement to utilise bristles of higher lengths and also to make brushes of the standard and finish required by the affluent countries.

Blood

36.2.12 At present blood is being collected only in a few slaughter

¹ Monthly Statistics of Foreign Trade of India, 1972-73. Director General, Commercial Intelligence and Statistics.

houses of the country. In the rest of the slaughter houses, it is wasted due to lack of suitable arrangements for collection. Annual collection of blood in India in 1967-68 was estimated to be a little over 50,000 tonnes.¹ Considering the number of animals slaughtered in the country, this is indeed a very poor rate of collection. According to the Directorate of Marketing and Inspection, the wastage of blood works out to nearly 64 per cent valued at Rs. 78,60,000. In developed countries, blood finds several important uses. It is consumed by human beings in the shape of black puddings and blood sausages, and blood albumen is employed as a substitute for eggs in the ice cream manufacture and in bakeries. It is used extensively for industrial purposes, as a fertiliser and is incorporated as an important constituent for the manufacture of stock feeds. In India only blood collected from sheep, goats and pigs is utilised for human consumption. It is consumed by the weaker sections of the society after frying it with spices or boiling it with rice. Occasionally it is mixed with wheat flour in the preparation of *chapattis*.

36.2.13 Collection of blood from all the slaughtered animals is highly important. When incorporated in the livestock feeds, it would provide a valuable source of animal proteins and as a fertiliser it would enrich the soil. Uncollected blood in a slaughter house becomes a serious sanitary problem. It quickly clots, choking drains, septic tanks etc. and rapidly decomposes serving as an ideal medium for bacterial growth. Blood collection on efficient lines will be possible only in modern slaughter houses as collection has to be done speedily and without dilution with water. Otherwise, processing would be prolonged making moisture removal highly expensive.

Goat Hair

36.2.14 Annual production of goat hair in India was estimated by the Directorate of Marketing and Inspection to be of the order of 8,200 tonnes. During 1972-73, about 3,500 tonnes of goat hair valued at about Rs. 74 lakhs were exported. We are informed that there is a great demand for goat hair in foreign countries. Vigorous propaganda is, therefore, necessary to bring home to the goat rearers, merchants and others regarding the economic importance of goat hair and its proper processing for export.

Horns and Hoofs

36.2.15 The estimated annual production of horns in India in

¹ Directorate of Marketing and Inspection, Government of India.

1967-68 was a little over 35,000 tonnes and that of hoofs about 28,000 tonnes. The wastage in collection in the case of horns has been estimated at about 60 per cent and in the case of hoofs at about 66 per cent.¹ Horns and hoofs constitute a very small portion of animal byproducts but because these are rich in keratin and have considerable value as fertiliser after conversion into meal, these have much economic value. The horn core is particularly rich in ossein which is used in developed countries for manufacture of gelatine. The export trade in buffalo horns and antlers fetched Rs. 6.2 lakhs in a year 1972-73. It is desirable that wastage in the collection of horns and hoofs is reduced as much as possible and export trade in these items is increased. Further, horns and hoofs left in the country should be processed for the manufacture of gelatine and the unutilised portion converted into meal for use as fertilisers.

Meat Unfit for Human Consumption

36.2.16 The annual production of useless meat, i.e., meat condemned for human consumption and meat which remains adhered to the bones and other tissues is estimated to be of the order of 23,000 tonnes.¹ Since useless meat is an excellent source of nitrogen in poultry feed and fertiliser for tea and coffee plantations, we recommend that such meat should be converted into meat meal and should not be wasted as is being done at present.

सत्यमेव जयते

3 UTILISATION OF FALLEN ANIMALS

36.3.1 The Agricultural Production Team sponsored by the Ford Foundation in 1959 stated that failure to make use of the carcasses of fallen animals is responsible for an enormous wastage of otherwise useful materials. It was recommended by this Team that desiccating plants fully equipped to process animal carcasses should be established on a subdistrict, district or regional basis and that incentive payments should be made to those who bring fallen animals to these plants. The Fourteenth Meeting of the Animal Husbandry Wing of the Board of Agriculture and Animal Husbandry (1961) recommended that each State should establish a suitable number of carcass utilisation and hide flaying centres with a view to preventing the colossal waste that is occurring at present. The Committee on Natural Resources of the Planning

¹ Directorate of Marketing and Inspection, Government of India.

Commission (1963) drew attention to the huge financial loss sustained due to faulty methods of flaying, curing of hides and nonutilisation of the byproducts of fallen animals and recommended the creation of suitable facilities for the utilisation of products from dead animals. The urgency for setting up suitable number of carcass utilisation centres of different capacities in different States has also been repeatedly stressed by the Khadi and Village Industries Commission, Union Ministry of Commerce, Union Ministry of Agriculture and Irrigation and the Central Council of Gosamvardhana etc. However, the progress has been very poor and only a few modern carcass utilisation centres have so far been established.

Economic Loss

36.3.2 It has been estimated that about 22.8 million carcasses of fallen animals are available annually. Out of this, hardly 53 per cent are being partly utilised and the remaining ones are completely wasted. The economic loss due to nonutilisation and underutilisation of carcasses and defective flaying etc. has been estimated to be about Rs. 50 crores per annum¹. Proper and full utilisation of animal carcasses would produce valuable sources of mineral and protein supplements to feed poultry, pigs and cattle. The demand for animal fats would also be met and large quantities of organic manure would become available. Employment opportunities especially for the weaker sections of the community which are directly connected with this trade would increase. Further, the quality of hides and skins would improve thereby boosting up foreign trade in leather and leather goods. By preventing the flaying of the carcasses in the open, one of the important causes for the spread of infectious diseases would be removed. Early removal of carcasses will also improve sanitary conditions.

Carcass Utilisation Centres

36.3.3 At present, the carcasses are being procured and handled mainly by the poorer sections of the community, who are financially weak and have no means to utilise the fallen animals in a scientific manner. With a view to making the best use of animal carcasses and inedible slaughter house offals etc., we recommend that a chain of well equipped carcass utilisation centres should be established by the State Governments throughout the country.

36.3.4 The Municipal Corporation/Committees, Gram Panchayats and other local bodies while giving contracts for lifting the dead

¹ Directorate of Marketing and Inspection, Government of India.

animals should ensure that the contractors have adequate facilities to process the carcasses. Preference should be given to the Animal Husbandry/Industries Departments and Khadi and Village Industries Commission/Boards in the matter of allotment of contracts. In the areas where there are hereditary/proprietary rights for lifting the carcasses of fallen animals, Government should construct suitable buildings, provide necessary equipment and facilities to serve as service centres to the flayers. The flayers who bring dead animals may be permitted to process the carcasses on nominal charges.

36.3.5 Carcass utilisation centres where more than 4-5 carcasses of large animals are likely to collect daily should be suitably equipped for processing the carcasses and for production of end products like meat meal, bone meal, meat-cum-bone meal under hygienic conditions. Since most of the carcasses are available in rural areas, it is essential to set up flaying and carcass utilisation units through cooperative societies of flayers and Panchayats. These units should be linked up with large carcass utilisation centres for reprocessing the end products where necessary. The places where new slaughter houses are being established or modernisation of the existing ones is taking place, it is necessary to make simultaneous arrangements for establishment of carcass utilisation plants so that inedible slaughter house offals could be processed economically. An estimate of the cost of setting up a flaying centre and a carcass utilisation centre is given in Appendix 36.4.

36.3.6 At present, there is considerable pilferage of fallen animals. The existing Acts of the Municipal Committees, Corporations and Gram Panchayats should be suitably modified to make it obligatory on the part of the owners of the dead animals to hand over the carcasses only to approved carcass utilisation centres. Wide publicity through modern audio-visual methods about the prospects of carcass utilisation programme should be given to arouse awareness among the masses.

4 SUMMARY OF RECOMMENDATIONS

36.4.1 The following is a summary of the important recommendations made in the text of this Chapter.

1. Urgent steps should be taken to considerably enhance production of wholesome meat as there is a wide gap between the availability and the demand for meat for human consumption. Programmes for development of sheep, goats and pigs particularly to

improve their meat qualities should be intensified.

(Paragraph 36.1.1)

2. Export trade for buffalo meat should be developed by improving the meat characteristics of the buffalo and fattening unwanted male buffalo calves.

(Paragraph 36.1.2)

3. Modernisation of slaughter houses should be undertaken immediately.

(Paragraphs 36.1.3 to 36.1.7, 36.1.14)

4. An organised marketing service for meat animals should be established in the cooperative sector. The livestock markets should be operated as terminal markets owned by the State Governments or cooperatives and should provide facilities for yarding, feeding and watering of meat animals. These should also provide veterinary services and banking facilities.

(Paragraph 36.1.9)

5. Studies should be undertaken immediately by the Directorate of Marketing and Inspection, Government of India and State marketing organisations to work out the *modus operandi* by which the farmers or the primary producers receive fair price for their animals and the consumers get good quality meat and meat products at a reasonable price.

(Paragraph 36.1.10)

6. The export of meat and meat products should be brought under the control of some organised agency like the State Trading Corporation and the quality control should be entrusted to the Directorate of Marketing and Inspection.

(Paragraph 36.1.12)

7. A Slaughter House Advisory Committee should be constituted under the Union Ministry of Agriculture and Irrigation for formulating a national policy for the betterment of the meat industry and to advise the Government on connected problems. The existing Slaughter House Unit in the Division of Animal Husbandry of the Union Ministry of Agriculture and Irrigation should be suitably strengthened.

(Paragraph 36.1.13)

8. In order to provide incentive to the State Governments for setting up slaughter houses, the Central Government may give about 50 per cent assistance as direct grant for establishing one modern slaughter house complex in each State during the Fifth Plan.

(Paragraph 36.1.14)

9. The scope of the Meat Food Products Order, 1973 should be enlarged so as to cover unprocessed meat as well.

(Paragraph 36.1.15)

10. Training courses should be arranged periodically for imparting

in-plant training to technicians required for work in the modern slaughter houses.

(Paragraph 36.1.16)

11. Research work on problem connected with production, processing and storage of meat and meat products should be intensified.

(Paragraph 36.1.16)

12. Improved methods of flaying should be introduced in the slaughter houses and better flaying should be encouraged by payment of premia to good flayers. More village flaying centres should be established for skilled flaying of fallen animals.

(Paragraph 36.2.4)

13. Demonstration-cum-training centres should be established in important places for imparting training in curing, tanning and rational utilisation of hides.

(Paragraph 36.2.4)

14. A system of compulsory preshipment inspection should be introduced for hides and skins meant for export.

(Paragraph 36.2.4)

15. Cold storage facilities for preserving raw hides and skins may be provided, wherever possible.

(Paragraph 36.2.4)

16. For effecting an improvement in the quality of the casings to boost export, sanitary conditions in the slaughter houses must be improved.

(Paragraphs 36.2.6 and 36.2.7)

17. The byproducts wing of each slaughter house should have a gut processing unit where it should be possible to process the guts under hygienic conditions.

(Paragraphs 36.2.6 and 36.2.7)

18. For increasing collection of raw bones, co-operatives of bone collectors should be formed and bone purchasing depots established in blocks. Flaying of carcasses should be allowed only at the flaying centres.

(Paragraph 36.2.8)

19. New bone digestors should be set up only in areas capable of utilising the bonemeal and should preferably be located in remote places unconnected by rail or road. Co-operatives of bone collectors should be provided with bone digestors on rent.

(Paragraph 36.2.9)

20. All big slaughter houses should have a byproduct plant within their precincts or in close proximity so that all available fats from slaughtered stock could be processed.

(Paragraph 36.2.10)

21. The pig rearers and bristle merchants should be educated re-

garding the economic importance of bristles, particularly as an earner of foreign exchange so that more bristles are collected and dressed for export.

(Paragraph 36.2.11)

22. Blood from slaughtered animals should be suitably collected and incorporated in the livestock feeds or used as fertiliser.

(Paragraph 36.2.13)

23. Vigorous propaganda is necessary to educate the goat rearers and the goat hair merchants regarding the economic importance of goat hair and its proper processing for export.

(Paragraph 36.2.14)

24. Export of horns and hoofs should be increased. Horns and hoofs left in the country should be processed for manufacture of gelatine and the unutilised portion should be converted into meal for use as fertilisers.

(Paragraph 36.2.15)

25. Meat unfit for human consumption should be converted into meat meal and used as an ingredient of the poultry feed and as fertiliser for tea and coffee plantations.

(Paragraph 36.2.16)

26. A chain of well equipped carcass utilisation centres should be established by the State Governments.

(Paragraphs 36.3.1 to 36.3.3)

27. The Municipal Corporations/Committees, Gram Panchayats and other local bodies while giving contracts for lifting the dead animals should ensure that the contractors have adequate facilities to process the carcasses. Preference should be given to the Animal Husbandry/ Industries Departments and Khadi and Village Industries Commission/ Boards in the matter of allotment of contracts.

(Paragraph 36.3.4)

28. In the areas where there are hereditary/proprietary rights for lifting the carcasses of fallen animals, Government should establish service centres with all facilities for the flayers. The flayers who bring dead animals to the centres may be permitted to process the carcasses on nominal charges.

(Paragraph 36.3.4)

29. Carcass utilisation centres, where more than 4-5 carcasses of large animals are likely to be collected daily, should be suitably equipped for processing the carcasses and for production of end products.

(Paragraph 36.3.5)

30. In places where new slaughter houses are being established or modernisation of the existing ones is taking place, it is necessary to make simultaneous arrangements for establishment of carcass utilisation

tion plants so that slaughter house offals could be processed economically.

(Paragraph 36.3.5)

31. The existing Acts of the Municipal Committees, Corporations and Gram Panchayats should be suitably modified to make it obligatory on the part of the owners of the dead animals to hand over the carcasses only to approved carcass utilisation centres.

(Paragraph 36.3.6)

32. Wide publicity should be given through modern audio-visual methods about the carcass utilisation programmes to arouse awareness among the masses.

(Paragraph 36.3.6)



APPENDIX 36.1

(Paragraph 36.1.7)

Cost Estimates and Economic Feasibility for Setting up Modern Abattoirs
of Three Different sizes

medium sized abattoir

capacity : 500 small animals and 100 large animals per day of
one shift.or
180,000 small and 36,000 large animals per year of
360 days.

I. capital investment

Rs.

(a) fixed capital on land and buildings	
(i) land: 6 hectares @ Rs. 25,000 per hectare	1,50,000
(ii) development expenses @ Rs. 50,000 per ha	3,00,000
(iii) buildings	
(a) plant building 1750 sq. m. @ Rs. 600 per sq. m.	10,50,000
(b) lairage 900 sq. m. @ Rs. 200 per sq. m.	1,80,000
(c) storage including welfare facilities 450 sq. m. @ Rs. 300 per sq. m.	1,35,000
(d) essential quarters 25 Nos. @ Rs. 20,000 per quarter	5,00,000
total fixed capital on land and buildings	23,15,000
(b) fixed capital on plant	
(i) cost of plant including erection	20,00,000
(ii) waste disposal plant	1,00,000
(iii) drainage, water and electricity @ 40 % of plant cost	8,40,000
(iv) vehicles	1,50,000
(v) contingencies @ 15 % of plant cost	3,15,000
total fixed cost on plant	34,05,000
total fixed capital (a + b)	57,20,000
(c) working capital (25 % of annual turnover)	5,95,000
total capital investment (a + b + c)	63,15,000

II. cost of processing

(i) purchase of byproducts for processing	3,00,000
(ii) utilities	
electricity: 1200 KWH per day at 15 paise per unit for 360 days—64,800	1,37,160
water: 36,000 gallons per day at Re. 1 per 1000 gallons for 360 days—12,960	
steam: 5½ tonnes per day at Rs. 30 per tonne for 360 days— 59,400.	
labour and supervision	
	2,70,600

APPENDIX 36.1 (Contd.)

	Rs.
(iv) repairs and maintenance	
6% on plant — 204,300	
2% on buildings — 43,300	2,47,600
(v) taxes and insurance at 2% on total fixed capital	1,14,400
(vi) depreciation:	
on plant at 10% — 340,500	
on buildings at 2½% — 43,300	3,83,800
(vii) interest at 8% on total capital investment	5,05,200
(viii) administrative expenses at 2% of annual turnover	47,600
total cost of processing	<u>20,06,360</u>

III. profitability

(i) annual income:	
by sale of processed byproducts	17,32,000
slaughter fees:	
(i) 36,000 large animals at Rs. 8	2,88,000
(ii) 180,000 small animals at Rs. 2	3,60,000
total income	<u>23,80,000</u>
(ii) net profit (Rs. 23,80,000 minus 20,06,360)	3,73,640
(iii) net return on investment: 6%	

small sized abattoir

capacity: 250 small and 50 large animals per day of one shift
 or
 90,000 small and 18,000 large animals per year
 of 360 working days

I. capital investment

(a) fixed capital on buildings and land	Rs.
(i) land: 4 ha at Rs. 25,000 per ha	1,00,000
(ii) development expenses at Rs. 50,000 per ha	2,00,000
(iii) buildings	
(a) plant building 850 sq. m. at Rs. 600 per sq. m.	5,10,000
(b) lairage 450 sq. m. at Rs. 200 per sq. m.	90,000
(c) storage including welfare facilities 200 sq. m. @ Rs. 300 per sq. m.	60,000
(d) essential quarters 20 Nos. @ Rs. 20,000	4,00,000
total capital cost	<u>13,60,000</u>
(b) fixed capital on plant	
(i) cost of plant including erection	12,00,000
(ii) waste disposal plant	67,000
(iii) drainage, water, electrical services @ 40% of plant cost	5,06,800
(iv) vehicles	1,00,000

APPENDIX 36.1 (Contd.)

	Rs.
(v) contingencies at 15% of plant cost	1,90,050
total capital cost	20,63,850
total fixed capital (a + b)	34,23,850
(c) working capital (25% of annual turnover)	2,97,500
total capital investment (a + b + c)	37,21,350
II. cost of processing	
(i) purchase of byproducts for processing	1,50,000
(ii) utilities	
power: 900 KWH per day at 15 paise for 360 days—48,600	98,280
water: 18,000 gallons per day @ Re. 1 per 1000 gallons for 360 days—6,490	
steam at 4 tonnes per day @ Rs. 30 for 360 days—43,200	
(iii) labour and supervision	1,93,000
(iv) repairs and maintenance:	
6% on plant — 12,383	1,49,031
2% on buildings — 25,200	
(v) taxes and insurance at 2% on fixed capital	68,477
(vi) depreciation:	
10% on plant — 2,06,385	2,37,885
2½% on buildings — 31,500	
(vii) interest @ 8% on total capital investment	2,97,708
(viii) administrative expenses @ 2% on turnover	23,800
total cost of processing	12,18,181
III. profitability	
(i) annual income:	
by sale of processed byproducts	8,66,000
by slaughter fees :	
large animals 18,000 @ Rs. 8.25	1,48,500
small animals 90,000 @ Rs. 2.25	2,02,500
	12,17,000
(ii) total expenditure	12,18,181
(iii) net loss	1,181

village sized abattoir

capacity : 20 small animals per day of one shift
or
7,200 small animals per year of 360 days

APPENDIX 36.1 (Concl'd.)

	Rs.
I. capital investment	
(a) buildings and land:	
(i) land 0.2 hectare	1,000
(ii) development charges	2,000
(iii) buildings:	
(a) plant 80 sq. m. @ Rs. 310 per sq. m.	24,800
(b) lairage 20 sq. m. @ Rs. 200 per sq. m.	4,000
total capital cost	31,800
(b) equipment	
(i) equipment	15,000
(ii) drainage and water @ 20% of plant	3,000
(iii) contingencies — 10%	1,500
total	19,500
total fixed capital (a + b)	51,300
(c) working capital (25% of annual turnover)	3,600
total fixed capital (a + b + c)	54,900
II. cost of processing	
(i) utilities:	
water — 1000 gallons per day @ Re. 1 per 1000 gallons for 360 days	360
(ii) labour and supervision:	
(a) supervisor — one @ Rs. 350 p.m.	4,200
(b) workers — 2 @ Rs. 4 per day for 360 days	2,880
(c) cleaner and watchman @ Rs. 100 p.m.	1,200
(iii) repairs and maintenance:	
(i) on equipment } @ 2% (on Rs. 50,000)	1,000
(ii) on buildings }	
(iv) insurance @ 1% on fixed capital	500
(v) depreciation:	
on equipment @ 5%	975
on buildings 2½%	720
(vi) administrative expenses @ 2% of annual turnover	288
(vii) interest on capital investment @ 8%	4,000
total cost of processing	16,123
say	16,000
III. profitability	
(i) annual income: 7200 animals @ Rs. 2.25 (slaughter fee)	16,200
(ii) annual expenditure	16,000
(iii) net profit (item i minus item ii)	200

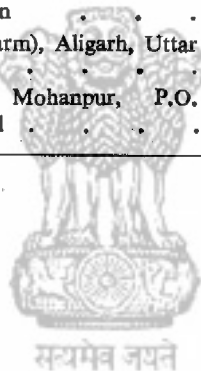
note: if private individuals take up the business, the overheads will be less.

APPENDIX 36.2

(Paragraph 36.1.8)

Location of the Modern Bacon Factories under Public Sector,
Their Installed Capacities and Present Production Level

Name of the factory	Capacity per day (pigs)	Production (1972-73) of pork and pork products per day (Kg)
bacon factory, Gannavaram, Krishna District, Andhra Pradesh	100	1,000
bacon factory, Kanke, Ranchi, Bihar	50	600
bacon factory, Kuthattukulam, Ernakulam District, Kerala	50	9,000
MAFCO factory, Borivili, Bombay-92, Maharashtra	100	3,000
pork processing plant, Kharar, Punjab	10-12	300
bacon factory, Alwar, Rajasthan	50	750
bacon factory (central dairy farm), Aligarh, Uttar Pradesh	100	2,500
bacon factory, Haringhata, Mohanpur, P.O. Nadia, District West Bengal	10-20	600



APPENDIX 36.3

(Paragraph 36.1.10)

Livestock Market in Bombay

A study

The livestock market operated in Bombay is the biggest livestock market in whole of India. The livestock, i.e., sheep and goats, are brought from all over India to this market from main producing centres, viz., Rajasthan, Mewar, Madhya Pradesh, Uttar Pradesh, Gujarat, Maharashtra etc. It is reported that the main bulk from these producing centres are sent to Bombay.

The various places from where animals are sent are as follows :

1. Rajasthan

- (a) centres: Jaisalmer, Gazado, Barmer, Mundabad, Bikaner, Jodhpur, Jaipur, Ajmer, Chittore, Marwar etc.
- (b) merchants: about 100 merchants operate from this area bringing animals from various centres to Bombay markets.
- (c) season: 8 months from July to February.
- (d) percentage: 80 to 90% sheep and 20-10% goats.

2. Mewar

- (a) centres: Ratlam, Bhilwara etc.
- (b) merchants: about 25 merchants are operating and bringing their animals to Bombay.
- (c) season: 4 months from July to October.
- (d) percentage: about 80% goats and 20% sheep.

3. Madhya Pradesh

- (a) centres: Indore, Bhopal, Ujjain.
- (b) merchants: there are about 20 merchants operating.
- (c) season: March to June — 4 months.
- (d) percentage: sheep and goats 20% and 80% respectively.

4. Uttar Pradesh

- (a) centres: Agra, Lucknow etc.
- (b) merchants: about 10-15 merchants operating from these centres.
- (c) season: about 2 months from April to May.
- (d) percentage: sheep and goats 50% each.

5. Gujarat

- (a) centres: Disa, Palampur, Sabarmati, Baroda, Surat, Kutch, Bhuj, Gandhidham, Jamnagar, Kathiawar, Rajkot, Viramgam etc.
- (b) merchants: there are about 100 merchants operating from Gujarat.
- (c) season: throughout the year from January to December.
- (d) percentage: larger percentages (90%) from the places are sheep.

6. Maharashtra

- (a) centres: Aurangabad, Jalana, Ahmednagar, Nagpur, Parbhani, Wardha, Jalagaon, Melegaon, Bhivandi etc.

APPENDIX 36.3 (Contd.)

- (b) merchants: more or less there are 50 merchants operating.
- (c) season: season runs from March to June—4 months.
- (d) Percentage: goats are in larger number about 80%; sheep about 20%.

7. Hyderabad area (Andhra Pradesh)

- (a) centres: Berar.
- (b) merchants: 8-10 merchants are there.
- (c) season: all the year.
- (d) percentage: mainly goats and small size 'deccani' sheep are brought.

Trend of operation

These herds of sheep and goats are reared in the villages on or around hilly tracks and fields. They are usually reared on natural vegetation in fields. The persons who are bringing up these herds are called by different names in the local languages in different places. They are called 'Dhangar', 'Gawal', 'Gharva-ya', 'Maldari', 'Reval' etc. The merchants and their agents visit these villages actually in the fields and on the hilly tracts, and directly deal with these persons. The farmer/the primary producer of the animals may have several herds grazing in the fields and surroundings. Depending upon the need and other circumstances the herds are taken out for sale.

The herds may consist anything from 50 to 100 animals or sometimes even upto 500-1000. From the herds intended for sale, males and females are separated out. The females are retained for breeding. From males separated, the merchants select animals on sizes or weights. Usually, in case of goats, males are one to three years of age. As for the females are concerned, they are culled for slaughtering after 3-4 years' breeding. In case of sheep, these animals are retained for a longer time for the sake of their wool before they are sold to the butchers. Animals usually brought in for slaughter are found between the age group—male around 2 years and females 3 years.

Bargain for the fixing of prices goes on and prices fixed are usually, on an average, per head. When the bargain is struck, the transaction of sale is in cash when the animals are removed immediately. It is also common practice to remove animals after upto 10 to 15 days after concluding the sale. In such cases, the animals are marked out and kept in producer's own charge and the token advance is paid by the purchasers. However, at the time of removing animals, whole amount is paid.

Animals purchased at different places in Maharashtra are collected at collecting areas/centres from all around, from a radius of 15—20 miles area. The lorries from the transport companies are engaged to transport these animals. Usually upto 150 animals are loaded in a lorry from these centres and brought upto Bhivandi. However, from Bhivandi to Bombay, these animals are divided and 50—75 animals are taken in each lorry. This is as per SPCA and RTO regulations operating in Bombay area. The trucks are engaged to transport the animals even from distant places from Rajasthan to Bombay and it takes about 24 to 48 hours and cost per head reported is about Rs. 15 to Rs. 20. However, by railways, it is about Rs. 15 but it takes about 4-5 days minimum to transport animals from Rajasthan to Bombay. The animals are brought from Rajasthan to Sabarmati in a metre gauge train and at Sabarmati they are changed from metre gauge to broad gauge; thereby there is a delay of a day. This gives time for grazing and exercise for these animals. Majority of animals from Rajasthan and Gujarat side, however, come by railway transport. The butchers and merchants prefer to transport their animals by trucks because animals arrive in good condition as it takes only 24 hours. Thereby shrinkage and loss of condition is far less as compared to railway transport where it takes 4-5 days. Out of about 24 lakhs of animals arriving in Bombay markets, about 14 lakhs come from Rajasthan, Indore, Kathiawar, Gujarat and about 10 lakhs from all other centres.

APPENDIX 36.3 (Contd.)

In certain parts of Maharashtra and Hyderabad area, a 'weekly bazaar' system operates in and around the neighbouring villages and townships. This weekly bazaar is called 'Hath'. They are called 'Mandi' also. Animals which are not sold in a particular weekly bazaar are taken to next village where the marketing is held on the next day or subsequent days. Thus, the marketing takes place on all the days of the week in different villages and intermediate operators, viz., the merchants and the brokers are kept busy going round these weekly bazaars all through the week. It also helps the butchers from the surrounding area to go to a particular bazaar and make their purchases as per their needs. This practice, it is said, is not in vogue in the North. Regular Mandi or marketing is, however, held at Surat, Baroda, Ahmedabad, Ajmer, Jodhpur etc. The excess unsold animals from these markets are dispatched to Bombay. The following table shows the number of animals brought for slaughter in Greater Bombay :

Number of Animals Brought to Bombay Livestock Market for Slaughter

Year	Sheep and goats	Buffaloes	Bullock (HC)	Pigs	Piglings
1963-64	1996315	10362	68090	14389	103
1964-65	1842659	11419	77288	14788	74
1965-66	1941483	12551	79607	14141	..
1966-67	2156393	17962	79677	12786	36
1967-68	2025808	18360	36290	11466	13
1968-69	2244088	19060	77079	10878	52
1969-70	2339381	18457	66010	10035	33
1970-71	2199285	18778	72987	10439	67
1971-72	2265395	12822	81803	13166	71
1972-73	2427457	12926	95523	16860	56

Wholesale Livestock Sale in Bombay

Livestock markets for sheep and goats is held in Bombay on 2 days of the week (Tuesday and Saturday)—Saturday's marketing is bigger. All the merchants bringing the animals from all these producing centres are issued with licences by the Municipal Corporation of Greater Bombay authorising them for importing animals into Greater Bombay. Any animal brought without such licence or prior permission from the Municipal Commissioner of Greater Bombay are liable to be seized and disposed of as per the provision of the Bombay Municipal Corporation Act. No sooner the animals arrive from the different centres, the animals are unloaded at unloading ramp of the marketing yard where immediate provision of drinking water and antemortem inspection etc. facilities are available. Animals found in exhausted condition and/or otherwise fit for emergency slaughter are taken for slaughter in the emergency unit. Animals found suffering from contagious or other scheduled diseases are dealt with segregated/quarantined. On unloading, the animals are handed over to "Gawals" or caretakers and they are looked after by them.

Modus operandi of the Middlemen in the deal with the Butchers

Only on the marketing days, these animals are brought to livestock market. The brokers or 'Dalals' operating in the markets take charge of these animals and sell them to the butchers. The *modus operandi* is that 20 animals of equal age and weight group are separated and price is fixed on bargain. On striking the bargain, the merchant is paid the price of the score 'Kody' by a banker of 'Pedhiwala' on behalf of the butcher. The commission enjoyed by the 'Dalal' and also the 'Pedhiwala' for selling and advancing money respectively is deducted from the prices of the animals paid to the merchants. The current rate of commission enjoyed by "Dalal" and "Pedhiwala" in Bombay markets is Rs. 9/-

APPENDIX 36.3 (Concl'd.)

each per animal. Average price of score of animals being about Rs. 1500, this works out about 62.5 per cent interest. The wholesale butcher is in a very comfortable position. He is not required to invest any hard cash in his business. Besides realising lucrative price for the mutton, he also receives good amount of advances from the dealers dealing in byproducts like skin, guts and edible offal or 'Kena' (viz., liver, heart, lung, head and trotter) dealers. Usually advance-sale of these byproducts takes place for three months. As these dealers pay advances to the butchers and he also is not required to invest hard cash in his business, he is not careful in handling and scrutinising the transaction for the price realised for these products. Thus, the dealers in trade try to exploit one another by under-quoting and under-mining, resorting to various tactics and malpractices.

Deonar Abattoir wants to organise Price Board to pay to the Butchers for byproducts

To provide a good opportunity and to remove the present malpractice in the trade, at Deonar abattoir, a scheme has been worked out; a 'Price Board' is proposed to be constituted with representatives of butchers and the intermediate operators and from the concerned trades. The slaughter house authority will look into and arrange for collection of these byproducts from slaughter houses immediately after slaughter and process and dispose to the different trade groups or pharmaceuticals as the case be. A fair price for these products, payable to the butchers will be decided, in consultation with all the members of the board. This price will be arrived at taking into consideration all the facts and circumstances, influencing the same; thus it will do away with indiscriminate exploitation and spoilage of the materials.

Bank Credit advance to the Butchers

A scheme is also suggested for Banking arrangement for advancing loans to the butchers through cooperative bank. On a guarantee given by 2 other butchers in a group of 3 butchers, advance of loan can be arranged to every butcher at fair interest of 9-10 per cent as against the present 62.5 per cent or even more as worked out above. This will benefit the animal merchant and thereby the primary producers. The retail butcher will also be under the administrative control of the Municipality which can also prevail upon him to see that the loan is paid back.

This scheme when introduced will facilitate direct sale on cash transaction. With the cash transaction and direct sale, malpractice adopted by the different intermediate operators viz., the butchers and traders, skin dealers etc. will also be done away with.

There is a system called 'Vanda' in the sale of skin. According to this, the price of skin that could be realised from animal is being assessed by the skin dealer and if the skin dealer disagrees to the price, that the butcher expects, the animals are returned back to the merchants later, even upto 24 hours after the sale. This puts the merchants in a very awkward position as when marketing hours are over, they cannot get suitable price for these animals and he is compelled to dispose them of at a lower price.

The cash transaction will also do away with another malpractice called 'Kasar' whereby 5 per cent deduction is made in the price of animal paid to the merchant for the guarantee of payment to be made by the butcher and as concession for regular purchasing.

It is also noticed that the prices of these animals realised at the markets at Bombay and other prominent cities and the prices paid to the farmers for these animals at their producing centres differ very much. The middlemen in the trade (agents or merchants) are realising greater margin. It is very much desirable to work out a scheme whereby these animals are directly transported to technical markets, avoiding these middlemen (merchant, agent, broker, pedhivala etc.) and actual price realised for the animals in the markets are paid to the producers directly. Even though the primary producer exerts all through the year and produces the livestock, he gets only meagre price and a lion's share from the price of the animals is taken away by these middlemen. Unless such schemes are worked out and introduced, if necessary by enactment, the economic condition of these primary producers will not improve.

APPENDIX 36.4

(Paragraph 36.3.5)

Estimate of the Cost of Setting up a Flaying Platform and a Carcass Utilisation Centre

I. flaying platform

non-recurring expenditure	Rs.
(i) cost of land and of construction of a flaying platform (15 sq. m.)	2,000
(ii) cost of tools and equipment like knives, sharpener, axe, spade, shovel, barrel etc.	500
(iii) arrangements for water supply such as installation of a hand pump	500
	<u>3,000</u>

recurring expenditure

an annual grant of Rs. 500 for buying new tools and equipment and for minor repairs.

note: the flaying platform will be a servicing unit and should be under the gram panchayat.

II. small carcass utilisation centre (wet rendering)

non-recurring expenditure

(i) cost of land and buildings consisting of flaying room, carcass utilisation shed, store room etc.	60,000
(ii) cost of tools and equipment for wet rendering plant	1,00,000
(iii) electric installations	40,000
(iv) transport for bringing the carcasses and raw animal material to the carcass utilisation centre (a tractor with trailer)	60,000
(v) provision for water supply such as sinking of a well	10,000
(vi) working capital for the purchase of carcasses, taking the contract for lifting carcasses etc.	50,000
total	<u>3,20,000</u>

recurring expenditure per annum

salary of one supervisor at Rs. 400 p.m.	}	27,600
two flayers-cum-operators at Rs. 300 p.m.		
three kamdar-cum-carcass lifters at Rs. 300 p.m.		
tractor driver at Rs. 400 p.m.		
miscellaneous expenditure such as electric charges, fuel, chemicals etc.		20,000
total		<u>47,600</u>

estimated receipts per annum

buffalo and cow hides 600, average sale price at Rs. 25 per piece	15,000
production of 30,000* kg meat-cum-bone meal to be sold at an average for Rs. 1.50 per kg	45,000

* raw material from 600 animal carcasses will be approximately 120,000 kg; the average recovery percentage of meat-cum-bone meal will be about 25%.

APPENDIX 36.4 (Contd.)

	Rs.
recovery of 1,200 kg of fat — sale rate Rs. 4 per kg	4,800
sale proceeds from horns, hoofs, hairs and manure etc. . . .	1,200
	<u>66,000</u>

note: small carcass utilisation centres should be set up in an area where there is scope of collection of about 600 carcasses of large animals in a year; the centre may serve a group of contiguous villages and should be under gram panchayat(s).

III. large carcass utilisation centre (dry rendering)

non-recurring expenditure

(i) cost of land and buildings (flaying hall, carcass processing section, grinding room, store room etc.)	2,00,000
(ii) cost of tools and equipment for dry rendering plant	10,00,000
(iii) electric installations	40,000
(iv) arrangements for water supply, such as sinking of a well	10,000
(v) transport for bringing the carcasses and raw animal material to the carcass utilisation centre (a jeep and a trailer)	40,000
(vi) working capital for the purchase of carcasses, taking the contract for lifting carcasses etc.	1,00,000
	<u>13,90,000</u>

recurring expenditure per annum

salary of one supervisor at Rs. 500 p.m.	6,000
two boiler mechanic-cum-driver at Rs. 400 p.m.	9,600
two flayers-cum-operators at Rs. 300 p.m.	7,200
eight kamdar-cum-carcass lifters at Rs. 300 p.m.	28,800 = 51,600
miscellaneous expenditure such as electric charges, fuel, chemicals etc.	50,000
	<u>1,01,600</u>

estimated receipts per annum

buffalo and cow hides 1500, average sale price at Rs. 25 per piece	37,500
production of 75,000* kg meat-cum-bone meal to be sold at an average of Rs. 1.50 per kg	1,12,500
recovery of 3,000 kg of fat — sale rate Rs. 4 per kg	12,000
sale proceeds from horns, hoofs, hairs and manure etc.	3,000
	<u>1,65,000</u>

note: large carcass utilisation centre should be set up in an area where there is scope of collection of about 1500 carcasses of large animals in a year; the centre may be set up near slaughter houses and in cities so that inedible offals from slaughter houses and dead animals could be processed at one place.

* raw material from 1500 animal carcasses will be approximately 300,000 kg; the average recovery percentage of meat-cum-bone meal will be about 25%.